AUTOMOTIVE and Aviation INDUSTRIES

SEPTEMBER 15, 1944

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Helping a new star ☆ Set a new record

Lockheed built it and called it the Constellation and it broke the Los Angeles-to-Washington speed record by 3 hours and 24 minutes. It develops more than 8,000 hp., cruising at high, overweather altitudes, and does it faster than many fast pursuit ships.

Normally, the Constellation can accommodate 57 passengers in its roomy air-conditioned cabin. But right now, it is working for Uncle Sam, accommodating as many as 100 fully-equipped men.

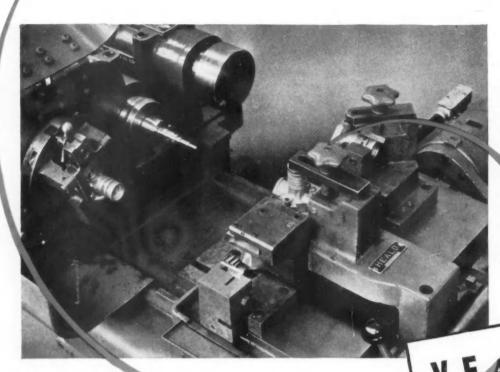
Many compact, friction-free Timken Bearings are giving the Constellation the all-important qualities of lighter weight, smoothness of operation, conservation of power, endurance and economical maintenance — as well as maximum radial and thrust load-carrying capacity. If these indispensable aircraft bearing features can help meet your requirements, why not write us. We'll be glad to make recommendations. The Timken Roller Bearing Company, Canton 6, Ohio.



TIMKEN
TADE MARK REG. U. S. PAT. OFF
TAPERED ROLLER BEARINGS

Fixtures for All Requirements

ON VERSATILE HEALD BORE-MATICS



This is fixture versatility . . . 13 different borizing operations are done on automotive governor bodies on the 3-station Heald No. 48A Bore-Matic shown here. Ready adaptability of Bore-Matics to practically any type of ixture made it possible to rotate one part in the front station, chuch a second piece in a stationary fixture in the middle station, and hold a third part in the rear station in a stationary fixture on a hydraulic cross-slide, the latter feeding the part for a facing operation.

HEALD DESIGNED TO SUIT YOUR JOB...
HEALD BUILT FOR BETTER, FASTER CHUCKING

You can improve accuracy, finish and production on all operations . . . on boring, turning, facing, chamfering, grooving, fly-cutting, on straight and taper surfaces, on curves and irregular shapes . . . by borizing on Heald Bore-Matics.

Versatility makes this possible . . . outstanding versatility in fixture methods, plus unusual flexibility in basic Bore-Matic design and tooling.

Widely diversified methods of work holding are available on Bore-Matics to suit all requirements. Work can be chucked in rotating fixtures or between centers, or can be held in fixed position in stationary fixtures. Stationary rotary-

indexing fixtures, horizontal or vertical types, can also be furnished. When required, stationary fixtures can be mounted on cross-slides for indexing or retraction from tools. Hydraulic, pneumatic or manual clamping is available.

All-round versatility... in application, function, tooling and fixtures make Heald Bore-Matics The Most Versatile Machine Tool. For more details, write... The Heald Machine Co., Worcester 6, Mass., U.S.A.



THERE'S A FIXTURE FOR EVERY BORIZING JOB...

- Rotating Fixtures.
- Stationary Fixtures.
- Horizontal Indexing Fixtures.
- Rotary Indexing Fixtures.
- Automatic Fixtures.
- All Types of Fixtures are Available With Either Manual, Hydraulic or Air Clamping.

HEALD Bore-Matics

THE MOST VERSATILE MACHINE TOOL



with the help of WAUKESHA

Powered by Waukesha Engines, two of a battery of big Ingersoll-Rand K-500 portable air compressors . . . mounted on the barge at the right... are shown helping to raise the U.S.S. Oklahoma after the Japanese raid on Pearl Harbor.

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ble

A battleship of some 29,000 tons, the Oklahoma had completely capsized before sinking. Lying in shallow water-bottom up-she had to be righted as well as floated.

To raise her, compressed air in large volumes was used—to force water in flooded compartments down and out through valves fitted to bottom platingor, to lower water by expelling it through holes in the hull, closing holes with emergency patches and then unwatering the compartments.

Here was another place where Waukesha wartime engines could and did help the Navy to speed up its tremendous task of sal-

vaging.

Seventeen months after Pearl Harbor 16 of the 19 ships that had been sunk

and damaged were salvaged and back in active service with our Navy.

When time counts . . . and it did here more than it ever had before ... you can push Waukeshapowered equipment far, fast and furious-all around the clock again and again until the job is done. That's dependability! Waukesha wartime engines have it. The new Waukesha peacetime engines will have it, too. Consult Waukesha about your future engine needs.

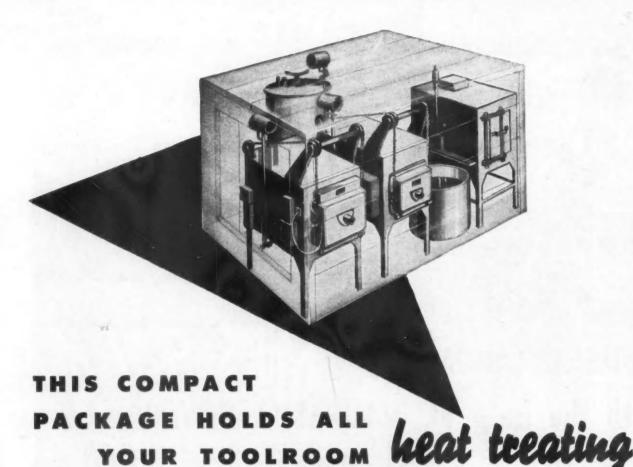
ESHA ENGINES



WAUKESHA MOTOR COMPANY, WAUKESHA, WIS. ● NEW YORK ● TULSA ● LOS ANGELES

September 15, 1944

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COMPACT setup for the precision heat treatment of your finest tools and dies is this Lindberg preheat furnace, high speed furnace and tempering furnace with complete quenching equipment.

The Lindberg Cyclone Tempering Furnace is the most widely used tempering unit in the field today because of its principle of recirculated hot air from an isolated heat source, together with the precise control which gives perfect tempering to meet the specifications calling for the desired toughness to give maximum tool life.

The preheat and high speed hardening furnaces employ the Lindberg Hydryzing process for hardening all tool steels. This saves the expense of costly cleaning operations such as sandblasting, polishing, stoning, etc. The neutral hydryzing atmosphere protects all tool steel from scale, decarb and carburization with the consequent assurance of long productive tool life. Where desired, Lindberg can also supply pot furnaces and complete equipment to meet any quenching requirements.

You can have all the advantages of clean, full hardening and accurate, low-cost tempering. Write today for ful information.

Typical of the tools hardened by the Hydryzing method is this bell shaped cutter of Moly High Speed Steel. Measuring 5" on its outside diameter, it weighs 81/4 lbs.

It was preheated in a Lindberg Hydryzing Furnace at 1500° E. for 48 minutes, then placed in the high speed.

It was preheated in a Lindberg Hydryzing Furnace at 1500° F., for 48 minutes, then placed in the high speed furnace for 12 minutes at 2225° F. It was quenched from 2225° F., into an 800° F. lead bath to avoid cracking at the sharp recesses of the teeth. From the lead bath it was allowed to cool to 150°-180° F.

In a Cyclone Toolroom Tempering Furnace, the cutter was heated for 2 hours at 1025° F., removed and allowed to cool to room temperature. Hardness was 65-67 Rockwell "C".



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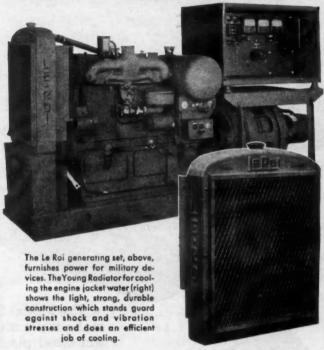
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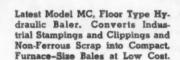
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• The Model MC Floor Type Hydraulic Baling Presses make it practicable and profitable for small and medium sized plants to bale sheet-metal scrap as it accumulates. With this powerful, compact, completely self-contained baler, the investment in equipment is comparatively low; power and labor costs are negligible. Installation costs are practically eliminated, as the MC baler requires no pit, may be installed at the most convenient location in the plant, and moved at little expense if necessary.

Even where sheet metal scrap accumulates at the rate of 5 tons per day or less, this type of press soon pays for itself not only through the higher value of the baled scrap, but through the saving of valuable floor space, the elimination of cluttering scrap piles, a smoother flow of production, the diversion of manpower to more essential tasks.

MC Floor Type Balers are built in several standard sizes and may be operated by unskilled labor, on a full-time or part-time basis.

For further particulars, write -

GALLAND-HENNING MFG. CO., 2747 S. 31st St., Milwaukee 7, Wis.

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SCRAP METAL BALING PRESSES

30,000 lbs.

Tensile Strength



60,000 lbs.

160/200

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CAST IRONS

Brinell Hardness



250/325

450° F.

Usable at Maximum Temperat<u>ure</u>



750° F.

30/40

Wear: Mgs. Weight loss per <u>hr.</u>



10/20

.024

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.007

In the past few years there has developed a better understanding of the effects of alloy additions upon the physical properties of gray cast iron.

Where the casting is to be subjected to elevated temperatures the proper alloy will prevent

Un-Alloyed Iron

Alloyed Iron

Values shown are

relative; exact range will depend upon conditions.

Where the casting is to be subjected to elevated temperatures the proper alloy will prevent breakage by retarding alteration of the metal structure under heat. Bearing or wearing qualities are improved by modification of the structure obtainable through alloys. Frequent starting and stopping and low jacket temperatures induce corrosion wear—controllable by the use of alloy irons with corrosion-resisting properties. Abrasive wear—a severe problem under dusty operating conditions—may require hardened alloy rings and cylinder liners.

These are but a few examples of the accomplishments possible by properly alloying good base irons. Environment will of course determine the type of iron for any specific application.

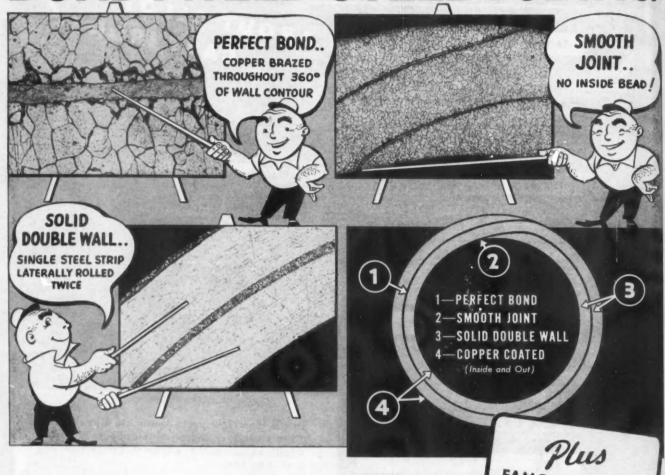
Specification of the right alloyed iron in the manufacture of the piston rings for your engine may solve troublesome problems. Consult Muskegon engineers and metallurgists freely. Their broad experience may prove helpful.

Buy More War Bonds!

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MUSKEGON, MICHIGAN PLANTS AT MUSKEGON AND SPARTA Hidden Superiority Proved by Photomicrographs



Tests and Experience Show Bundyweld Advantages in Wide Field of Applications

For best results, choose Bundyweld. This famous solid double walled steel tubing provides great resistance to vibration fatigue, assures a soft temper and uniform wall thickness. It is laterally rolled from a single copper-coated S.A.E. 1010 steel strip, copper brazed throughout. Furnished hard or an-

nealed in a wide range of standard diameters and gauges up to 5/8" O.D. Special sizes, cold drawn as desired. Also furnished in Monel. Bundy Engineers will be glad to show you how Bundyweld can assist you on your war or peacetime tubing problems. Write direct to Bundy Tubing Company, Detroit 13.

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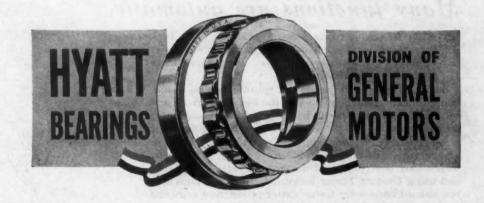
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* A Brilliant Record of war-time operation is being established by the trucks, buses and cars whose builders assign Hyatt Roller Bearings wherever the going is tough. Figure what this means in handling today's transportation job on the battle fronts as well as the home front-the greatest in automotive history!

Hyatt roller bearings are built to last—and require a minimum of care. But don't forget to give them the proper attention all precious anti-friction bearings deserve today.



HYATT BEARINGS DIVISION - GENERAL MOTORS CORPORATION - HARRISON, NEW JERSEY

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EASIER TO OPERATE . . .

Many functions are automatic

EVERYTHING about these modern Gisholt Ram Type Turret Lathes has been simplified to make them easier to operate... to eliminate waste time... to reduce fatigue... to speed up production.

Such advantages as automatic spindle-braking, automatic indexing and clamping of the hexagon turret, and selective automatic speed changing relieve the operator of many motions and cut the lag in machining time.

We couldn't, in one short advertisement, begin to enumerate all of the time and effort-saving refinements which have been perfected through 60 years of building and using Gisholt Turret Lathes. But they are facts that you should know—for faster, easier production now, and in the years ahead.

Ask a Gisholt engineer to tell you about them. Or write for descriptive literature.

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RESISTS SCRATCHES, PERSPIRATION

Nitrocellulose lacquer protects metal and other surfaces from acids, alkalies, perspiration and scratches. Easy to apply-fastest-drying finish

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Nitrocellulose lacquer protects surfaces with a waterproof film, makes them easy to wash. Equally adaptable to fine craftsmanship or economical assembly line methods.





Nitrocellulose lacquer may be applied in many ways, including rollercoating. It is so flexible that articles may actually be finished first, then formed, as in metal covers for alass jars.



TOUGH, DURABLE, FLEXIBLE...

Flexibility makes it ideal for fabric finishes. Tough enough to stand hard outdoor use. Durable—will not crack, peel, or blister.

RESISTS OILS, ALKALIES, ACIDS

No other finish can give you the same protection against oils, alkalies, acids, fingerprints, fats, stains, chafing—yet at the same time offer such unlimited color possibilities, beauty, and economy.





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Hercules makes no finished lacquers, but supplies the base nitrocellulose from which lacquers are made. For helpful information on your finishing problem, call your lacquer supplier. Cellulose Products Department, Hercules Powder Company, 964 Market Street, Wilmington 99, Delaware.



Yesterday—Gun ordnance manufacture was not yet an industrial art in Civil War times. Crude, cast gun barrels, lack of recoil mechanisms, and loose tolerance machining limitations made artillery fire a mechanically haphazard accomplishment.

World War I introduced the dependably accurate precision of the French 75 mm. gun. It could take the roughest kind of field handling. It could always register on a target with only a few rounds, and thereafter remain registered under a high rate of fire.

PHOTO COURTESY "ARMY ORDNANCE



Today—Tactical requirements of the present War have demanded new types of guns. They must fire heavier caliber shells faster, farther and for a longer time. They must outrange and out-fight all enemy guns. Increased muzzle velocities, better control of the shell trajectory, reduction of fouling of the lands and grooves of the rifling are all major requirements in modern high power, fast firing guns. These accomplishments are made possible by the hone abrading method of metal processing.



Microhoning
Helped develop the
DEPENDABLE
PRECISION
of Modern Ordnance

Tomorrow—When at last peace may come again, the guns of industry must be accurately registered and rapidly

demolish the many targets of pent-up demands for industrial goods. Time—and methods—will be of the essence, Microhoning will be ready with new developments offering substantial mechanical advancement and time saving over pre-war methods.

Microhoning is a process of finish machining which generates bore accuracy for roundness and straightness within .0002" to .0003"—which removes up to 65 cubic inches of stock per hour, has been developed into many ramifications, now being used for war machines. Tomorrow they will be available to speed peacetime production.

MICTOMATIC HONE CORPORATION . Detroit 4, Michigan
MAKERS OF HONING MACHINE TOOLS



Shooting the "BIG DUCKS" MILES AWAY

Shooting enemy planes at a distance of several miles is like shooting big ducks on a grand scale. The gunner must "lead" the target to allow for its movement while the shell is getting there.

Hence, the antiaircraft gun is never sighted at what it is trying to kill—but at some point in advance of the target.

The eye and experience of the most expert duck hunter would be of little use in shooting these "big ducks." The pointing of the gun is a complicated mathematical problem, solved by an elaborate plotting machine. The gun must follow orders of this plotting device with utmost exactness.

Without precision of the very highest order in every critical part, the gun couldn't hit the "big ducks." Antiaircraft fire would be mildly annoying instead of having deadly accuracy.

Microhoning contributes largely to this re-

sult because it provides the modern production approach to precision in final stock removal—maximum precision control of surface character.

Without this production approach to precision, it would be impossible to build these "big duck" guns in the quantities needed.

Some Microhoned Bores in Antiaircraft and Other Ordnance

Rifle Barrel Lands • Rifle Barrel Grooves • Recuperator Cylinders • Regulator Cylinders • Variable Recoil Cylinders • Rifle Hoops • Tapered Gun Chambers... (Guns from 2½ feet to 75 feet long—.30 caliber to 16 inch in diameter).

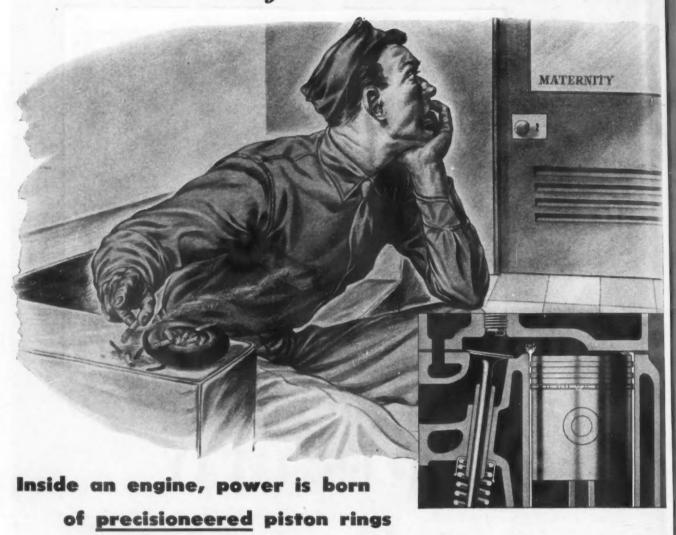


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DETROIT 4, MICHIGAN

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It's what goes on INSIDE that counts



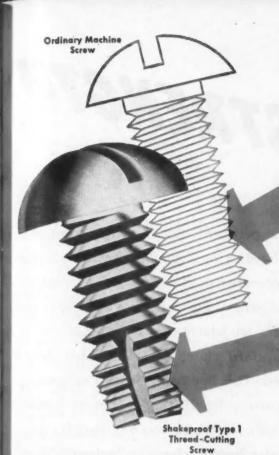
Only the most precise piston rings will deliver full power for longest life. They must be precise in every way—in width, thickness, diameter, flatness, circularity, tension. It is because of the extremely close tolerances to which all Pedrick piston rings are made that they are called precisioneered.

Innumerable tests and records of experience over a quarter century show that, with piston rings of identical design, it is possible... by improving just the precision of dimensions and characteristics... to raise performance by 50%, and frequently by even more.

Pedrick precisioneering is represented in the amazing performance of the Army's latest fighter planes. It has helped make possible the fastest level flight ever made by man. Whether you are concerned with engines, pumps, compressors, or hydraulic equipment, you will invariably find that Pedrick piston rings can take it! WILKENING MANUFACTURING Co., Philadelphia 42, Pa. In Canada: Wilkening Manufacturing Co. (Canada) Ltd., Toronto.

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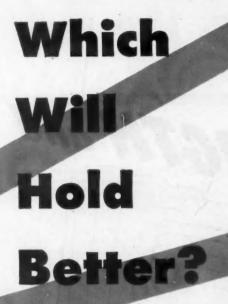
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SPECIAL HARDENING PLUS CLOSE-FITTING THREAD CONTACT GIVES SHAKEPROOF THREAD-CUTTING SCREWS EXTRA STRENGTH AND HOLDING POWER!

It's a fact! Shakeproof Type 1 Thread-Cutting Screws have considerably more strength than ordinary machine screws!

By means of its "built-in-tap" the Shakeproof Type I actually cuts its own thread in metal and assures maximum thread-contact in all thicknesses of metal. Because this screw remains in the thread it has cut for itself, there is a perfect mating with no "play" between screw and work, providing a stronger, tighter fastening than is ordinarily possible with machine screws in pre-tapped holes. Try them yourself . . . write today for free test kit No. 22!



CALL IN SHAKEPROOF FOR THE LATEST DEVELOPMENTS IN MODERN FASTENING TECHNIQUE

Shakeproof Engineers are ready to help you improve your product performance, speed production, and reduce assembly operation and costs. A thoroughly equipped laboratory, manned with experienced fastening engineers, provides a special service that assures better-fastenings for your particular applications. A field engineer will be glad to call and analyze your product—and suggest new ways that will lead to increased utility. Write today...he will be immediately assumed to help you!



Distributor of Shakeproof Products Manufactured by ILLINOIS TOOL WORKS
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Shakeprouf Type 25 Thread-Cutting Screws for Plastics



Sems Fastener Units
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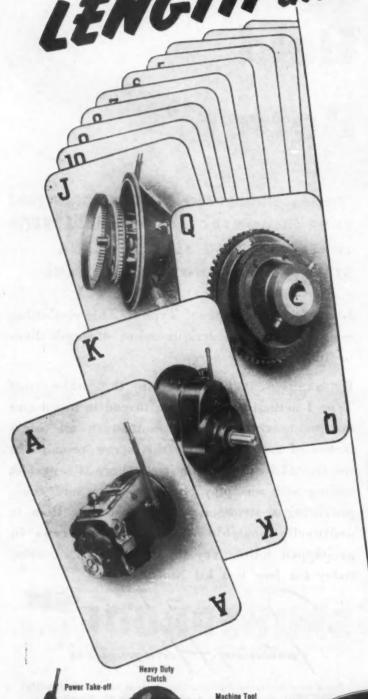


Shakeproof Cowl Fasteners . . . 'The Quick-Opening Lock'

LENGTH and STRENGTH

The pertinent data which is constantly relayed to the Twin Disc factory, plus the cooperation of those who design industry's machinery and tools, provides the broad basis on which the Twin Disc line of standard clutch units has been developed. This line has grown to so comprehensive a length that within its various models and sizes, you will find the particular friction clutch or hydraulic drive you need.

The records of thousands of diversified applications prove the strength of this line of standard clutches . . . their uniform performance and ample wear-life. To further assure this sustained leadership, the Twin Disc Clutch Company established 7 factory branches and 30 parts stations where engineering counsel is available and ample stocks of replacement parts are conveniently located. Twin Disc Clutch Company, Racine, Wisconsin (Hydraulic Division, Rockford, Illinois).



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September 15, 1944

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What Industry Can Do Now **About Contract Termination**

Charles H. Hummel, Comptroller of the Bendix Aviation Corporation, discusses in this comprehensive article what steps can be and should be taken immediately and in days near at hand to prepare for the rapidly approaching time when the many vital and complicated problems of termination must be handled promptly and effectively.

Hydraulic Control System for Single Engined Combat Plane 20

This discussion of the problems involved in the designing of the means for meeting requirements that are extreme and exacting is the result of collaboration between an airplane company engineer and a hydraulic control equipment engineer.

Trends in Design of Airplane Engines

In his Wilbur Wright Memorial Lecture, Sir Roy Fedden, President of the Royal Aeronautical Society, dealt at remarkable length with this subject. This article is a presentation of his views as to the lines and limitations of development of the reciprocating piston-type power plant and his reasons for believing in the eventual adoption, about 1960, of the gas turbine.

Airplane Engine Pistons, American and Foreign

A comparison of the geometry, weight, material composition, unit power loading and other characteristics of the pistons in some military aircraft engines of American, British, French and Russian manufacture and an evaluation of some widely different types of designs.

From Bauxite to Bomber 38

This is a Geschelin story on the fabrication of Reynolds aluminum, dealing particularly with the production of aluminum where bauxite is refined, the making of aluminum sheet, bars, rods and extruded shapes, and the conversion of these into finished parts ready for assembly into airframes.



Freedom and a Good Society

By John W. Scoville

THE designer of an automobile must be guided by the principle of balance or compromise. If he builds too much speed into the car, he must sacrifice economy. Great weight to give riding comfort would interfere with quick acceleration. The increase in one desirable feature reduces some other desirable feature. The problem of the engineer is to effect a proper balance or compromise. It is impossible to construct a perfect automobile; that is, one that possesses all desirable qualities to a superlative degree. It is likewise impossible to have a perfect society—we cannot have security, opportunity, freedom, riches, high wages, high profits, cheap goods, short hours, full employment, and abundance. More security means less opportunity-more opportunity means less security. If we have high wages, we cannot have cheap goods. If we have full employment, we must give up freedom. We are confronted with the inexorable principle of balance. Our good society must be a compromise between desirable but conflicting objectives.

It is my belief that a good society will satisfy the following requirements:

1. The payments to each individual shall be based on his con-

tribution to the social product. John Smith found that his Virginia colonists would not work, so he laid down the rule:
"He who will not work, neither shall he eat."

The value of what a person produces shall be what his fellows will freely give him in exchange for it. Prices shall be determined in free markets, where sellers strive to get a high price and hypers are hunting for harrains.

price and buyers are hunting for bargains.

A person shall own what he produces and be free to consume it, save it, sell it, move it, or rent it, without interference. Moses recognized property rights, for he gave the commandment—Thou shalt not steal.
4. Prices and production shall be regulated by competition, and

rrices and production shall be regulated by competition, and no persons shall be allowed to combine in a trust, association, cartel, labor union, guild or co-operative for the purpose of restraining trade, limiting competiton and reducing output. Since every law is a limitation of freedom, the government shall be limited in scope and perform only those functions which cannot be done equally well by individuals or voluntary essociations.

associations.

 Since concentrated power leads to tyranny, the powers of government shall be distributed among many persons and agencies.

7. Centralized government shall do nothing which can be done equally well by local governmental agencies.

8. All citizens shall be equal before the law. No class legislation shall be enacted to benefit or penalize any group or class.

The great political thinkers who founded this Republic drew up a constitution which, in conjunction with the common law, gave effect to the foregoing principles. What happened? In one hundred and forty years we became the richest and most prosperous country in the World. We accomplished more in a century than Europe accomplished in a thousand

(Turn to page 102, please)



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QUICK, DEPENDABLE SHIPMENT

AUTOMOTIVE and AVIATION INDUSTRIES Published on the 1st and 15th of the month September 15, 1944 Volume 91, No. 6

By Charles H. Hummel

Comptroller, Bendix Aviation Corp.

Organizing to Handle War

Contract Termination

HEN the avalanche of war contract terminations comes, industry must be prepared. Contractors and subcontractors must realize that the major part of the work with respect to settlement of terminated contracts will ultimately be borne by them. It is therefore in their particular interest that careful and complete plans be established to take care of this problem.

No contractor can successfully cope with this problem without designating someone as supervisor of contract terminations. This individual must be a qualified executive who will have complete authority to handle all termination activities. Where volume warrants, it may be desirable to appoint a Termination Committee comprising key employes in accounting, legal, production and material control, purchasing

and other departments, which employes will be responsible for the various stages of processing termination claims. In those cases where contractors have several subsidiaries and divisions, termination supervisors should be appointed for each facility. The functions and authority of all personnel connected with termination activities should be clearly defined. Termination personnel should not be burdened with duties pertaining to the regular operation of the company. Concise termination instructions, together with related forms covering procedures to stop work, notify subcontractors and suppliers, take inventories, divert and dispose of materials, account for Government-owned property and complete compilation of claims, should be prepared by all contractors so as to permit the fast processing of claims on all contract terminations as received.

The basis for all settlements is the claim the contractor submits to the contracting officer, including charges of subcontractors, as well as his own charges. Without a claim, the Government cannot commence its various reviews thereof culminating in final settlement. Wherever practical, partial claims should be filed with the cognizant contracting officers to permit the commencement of their reviews in advance of receipt of the final summary of the claim. Generally, subcontractors do not deal directly with the Government and are therefore more apt to have difficulties in settling claims than prime contractors. Contractors must recognize the rights of others in lower tiers and therefore, in addition to submitting their own charges promptly, they must also provide for the rapid review and presentation of their subcontractors'

THAT war plants of the country are producing guns, tanks, aircraft, motor vehicles, ships and other munitions at the annual rate of \$70-billion and have on hand inventories of about \$10-billion in raw materials, goods in process and finished war goods provide some idea of the magnitude of war contract termination that will confront American industry when hostilities cease. The War Production Board estimates that, at the end of the war with Germany, military production will be reduced approximately 40 per cent. Officials of the Army Air Forces state about 33 per cent of the warplane program will be terminated.

To prepare for a large scale cutback, contract termination training programs are being conducted throughout the nation. On August 28 a contract readjustment and termination forum was held in New York City under the auspices of the Eastern Procurement District of the AAF Materiel Command, at which some 2700 war contractors were addressed by high ranking Government and Army officials, including Robert A. Lovett, Assistant Secretary of War for Air; Brig. Gen. Frederick M. Hopkins, Jr., Lt. Gen. William S. Knudsen, Maj. Gen. Bennett E. Meyers. Industry was represented by Charles H. Hummel, of the Bendix Aviation Corp., who discussed what contractors may look forward to and can do now. Excerpts from Mr. Hummel's talk are presented herewith.

claim to the contracting officers concerned. To facilitate the settlement of claims, contractors should adhere strictly to applicable regulations. In order to accomplish this, it is vital that all key personnel are fully informed with respect to the provisions of the Contract Settlement Act of 1944, related regulations, and the termination procedures of the contracting officer with whom the contractor is filing the claim.

The best approach for expediting the processing of claims within your own organization is to establish definite time schedules for completing various phases of the work: that is, (1) Taking of the inventory; (2) The costing of the inventory; (3) The screening of the inventory for diversion, disposal and scrap

recommendations; (4) Obtaining vendors' inventories and complete claims and making appropriate examinations thereof, etc. The Supervisor of Contract Terminations should control these time schedules to see that they are maintained.

If the job of settling terminated contracts is to be done effectively, contractors should not waste valuable man hours on insignificant items. This does not mean the inclusion in claims of items based on haphazard estimates. Sound judgment must be exercised. Ultimately, time will be saved if all claims are carefully reviewed and checked after their preparation and prior to submission to the contracting officer, in order to ascertain that they are accurately compiled and conform to applicable regulations. The contractor's job is not done upon submission of his claim to the contracting officer. Termination personnel should make it their job to obtain action for settlement of their claims. With this in mind, it is definitely desirable to set up mutually satisfactory schedules with Government personnel. Such schedules have the purpose of setting dates when Governmental clearance may be expected with respect to the various phases of its work, such as accounting reviews, property disposition and removal, negotiation and final settlement of the

In order to speed up the settlement of pending claims

it has been found helpful to agree on a priority schedule for settling claims. Personnel of the contracting officer and the contractor then work concurrently on the clearance of the same claim. Much time can be saved if contractors will obtain from Government agencies in advance of termination approval of their termination policies. Policies to be approved include, among others, methods of allocation of overhead, administrative, engineering, other indirect costs and post termination expenses. Where practical, decisions should also be obtained in advance of specific problems, such as those relating to the removal or storage of termination inventories, the treatment of common tools where there are other continuing procurement contracts, etc. Emphasis must be placed on settling claims, which will enable the contractor to become fully aware of the methods and procedures of the particular contracting agency.

Procedures should be established to profit by such experience in order to eliminate similar complications in the future. Each prime contractor should take steps to initiate termination training programs for his own staff as well as for the personnel of his subcontractors. While valuable training may be obtained in

WHAT COSTS CAN CONTRACTORS INCLUDE?

Yes!

If found to be reasonably necessary for and properly allocable to the terminated contract, and in accordance with the "Statement of Principles for Determination of Costs upon Termination of Government Fixed-Price Supply Contracts approved by the Joint Contract Termination Board, December 31, 1943":

- 1. Cost of Inventory
- 2. Subcontractors' Claims
- 3. Depreciation
- 4. Experimental and Research Expense
- 5. Engineering and Development and Special Tooling
- 6. Loss on Facilities
- 7. Special Leases
- 8. Advertising
- 9. Interest on Borrowed Funds
- 10. Settlement Expenses
- 11. Protection and Disposition of Property
- 12. Initial Costs

- 1. Losses on Other Contracts
- 2. Expense of Conversion to other uses
- 3. Expenses due to Negligence
- 4. Costs in Excess of those required for the Contract
- 5. Costs already allowed in Renegotiation

NOTE: The termination claim plus the amount paid or payable on completed items may not exceed the sum of the total contract price and post-termination expenses.

Government sponsored schools, staff training must also be undertaken by key termination personnel of the contractor, so that newly assigned employees will be fully acquainted with their own methods and the specific duties they will be required to assume. Any such training program should be certain to include among other things—(1) Methods for inventory taking; (2) Procedures to be followed in the screening of inventories for diversion, disposal and scrap recommendation; (3) Field audits and office reviews of subcontractors' claims; (4) Procedures for accelerating the receipt of claims upon subcontractors and vendors; (Turn to page 122, please)

Developments and Problems of the

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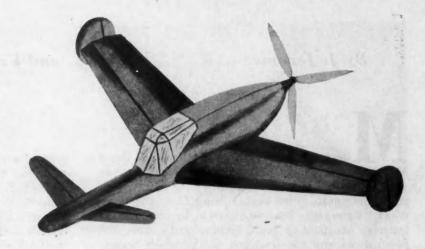
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Canard Aircraft



By M. W. Bourdon

Special Correspondent of Automotive and Aviation Industries in Great Britain

DVANTAGES and shortcomings of canard-type aircraft and design problems involved were discussed in a recent issue of the German periodical Flugsport. Here is presented a condensed version of the article, a translation of which was provided by the British Ministry of Aircraft Production. The author contends that fully developed modern aircraft are hardly capable of further improvement, if increased power, new propulsion methods or other ways and means of improving performance at the expense of landing speed and flying properties are excluded. The airframe designer is thus faced with the fact that the only hope of improving performance under such conditions is to abandon the usual design standards and strike out on new paths.

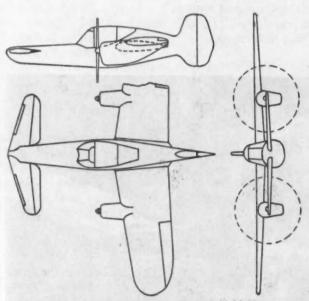


Fig. 2—Design for two-engined canard-type aircraft

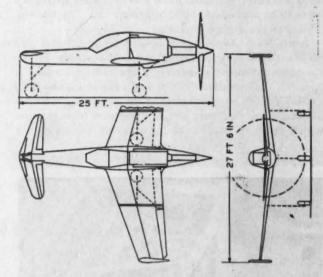


Fig. 1—Design for single-seater, single engined canard-type fighter aircraft

Compared with conventional aircraft of today, it will be found that the canard-type possesses important advantages. The elevator unit, being in front, fully contributes to the total lift of the aircraft; in effect, it is part of the wing unit and, in consequence, develops no parasitic drag. For a given lift, the equivalent wing area of a normal aircraft can be reduced by the corresponding elevator surface area, amounting to about 25 per cent of the standard wing area. Calculations on several fighter types showed that elevator drag is about 10 per cent of the total; if this be eliminated about 3.6 per cent increased speed can be obtained. A further reduction in drag can be obtained by the reduced dimensions of the canard fuselage.

Freedom from spin has hitherto been considered the principal advantage of the canard type. Installing, breakaway takes place first at the leading edge of the elevator plane, and, since the CG is in front of the wing, the machine noses over and recovers speed. Consequently, when the elevator controls are "full over" the forward flight of the aircraft proceeds in a steady oscillation. In upward gusts, however, the easy flow.

(Turn to page 64, please)

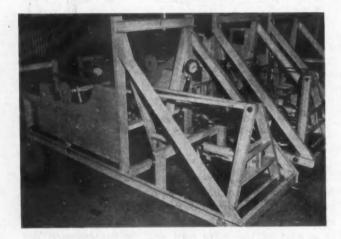
odel x was on the drawing board. It was a single-engined, single-place combat plane to be equipped with a hydraulic system for the operation of its landing gear, wheel brakes, wing flaps, and bomb doors. Emergency operation was to be provided for lowering the landing gear, opening and closing the bomb doors and for actuation of the wheel brakes. Standard and commercially available parts were to be used wherever possible, known and proved principles were to be applied to expedite design and construction. This was the design problem.

Army-Navy Aeronautical Specification AN-H-2 sets up standards of size, rating and test methods for all the units commonly employed in hydraulic systems. It specifies the standard fittings and tube sizes, the fluid (AN-VV-0-366), packings and gaskets, the methods of calculating reservoir size, and includes requirements which years of experience have proven necessary for

proper safety and efficiency. The hydraulic system, according to the specification, must demonstrate its ability to function satisfactorily with hydraulic fluid at temperatures ranging from minus 65F to plus 160F. Specially constructed cold rooms throughout the country are daily attesting to the fact that this requirement can and is being met. Stories of frozen hydraulic fluid and brittle hose are completely out of date.

Power Supply or Main Circuit

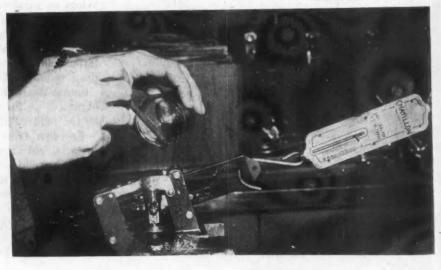
The function of the main circuit is to supply a source of fluid under pressure, and to maintain that pressure within required limits. This may be accomplished in many different ways. The method used on this particular airplane is the pressure regulator, or unloading valve system, the principal components of which are the reservoir, constant displacement pump, pressure regulator, accumulator, relief valve and filter.



Designing the Single Engined

(Above) Typical operational test set-up for cylinders under load

(Right) Landing gear lock pins must operate despite sand, mud or dust. Test programs at Consolidated Vultee's Downey plant call for exhaustive checks of such parts before they are installed on the prototype airplane



AUTOMOTIVE and AVIATION INDUSTRIES

Test stand for cycling landing gear retraction and locking mechanism under load

arranged as shown in the schematic diagram, Fig. 1. This circuit maintains a pressure of 1250 to 1500 psi in the accumulator at all times. The output of the pump is by-passed through the pressure regulator back to the reservoir against no pressure, except when the system pressure drops to its lower limit, whereupon the by-pass is cut off and the pump is forced to recharge the system to its maximum or cutout pressure.

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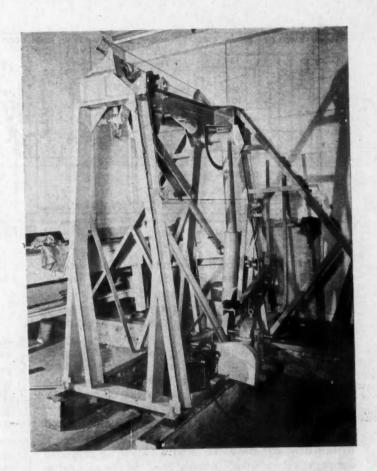
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The hydraulic reservoir is the source of oil supply for the power pump, the emergency source of supply for the hand pump, and the container for the filter. The suction standpipe in the reservoir, through which oil is drawn to the engine pump, must be so located that it cannot draw air in any normal flight attitude. It is desirable that the design of the reservoir be such that all the oil within it be in constant circula-



Hydraulic System of a Single Place Combat Airplane

tion in order to achieve a maximum heat dissipation. Also, the air which is returned to the reservoir should be deflected from the suction standpipe and eliminated as far as possible.

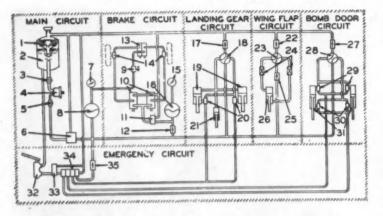
Since aircraft hydraulic units are fine, close fitting mechanisms, it is essential that the oil in the entire circuit be as clean as possible. The presence of small impurities in the oil can score hydraulic pumps, valves or cylinders so badly that they can leak excessively, malfunction, or even become completely inoperative. That makes the degree of filtration and the placing of the filter in the system a vital consideration. Recently a paper filter has been evolved which filters all particles 10 microns (0.0004 in.) in size, and 90 per cent of those 5.0 microns in size. It has sufficient dirt capacity before clogging, so that, unlike previous filters, it requires no periodic servicing.

Several locations for the filter were considered, and it was decided to place it inside the reservoir. There, beneath both the return line and the filler neck, it filters all the fluid entering the system, as well as all the fluid circulating in the system, at the same time maintaining low operating pressure and pressure drop.

Being directly under the filler neck, the mechanic has the opportunity of gaging the condition of the filter by observing the speed of flow of refill oil during servicing. Excessively slow flow will be an indication of probably filter clogging, while excessively fast flow will be a sign of a damaged filter.

The engine driven pump is a constant displacement pump whose output is proportional to the engine rpm. The selection of the pump size depends upon the maximum power required by any of the hydraulic services. In this case, as in most cases, the maximum rate of work consisted of the retraction of the landing gear. The pump is mounted on the engine accessory drive and stays with the engine when the engine is dismounted from the airplane for servicing. Quick disconnect couplings in the pump pressure and suction lines automatically plug the lines and prevent the loss of fluid when the lines are uncoupled.

The pump suction line is a critical part of the system because it is a determining factor of the absolute pressure at the pump suction port. The volumetric efficiency of the pump starts to fall rapidly at 10 psi absolute pressure. At 5.0 psi absolute pressure, the



volumetric efficiency of the pump is about 60 per cent. At still lower pressures the output is very erratic. Although modern pumps may run cavitated for long periods of time without causing any damage, it is well to investigate the power output of the pump available for services at high altitude.

It was considered advisable on this airplane to limit the minimum absolute pressure at the pump suction port to 5.0 psi at cruising rpm, 25,000 ft altitude, and plus 20F, in order to reduce the strain, and thereby lengthen the life of the pump. The pressure drop through the line is a function of temperature, or viscosity, diameter, and rate of flow. Several charts in common use make the determination of line size comparatively simple. Among them is the calculator developed at Consolidated Vultee, which is illustrated in Fig. 2.

In some installations, the main circuit accumulator

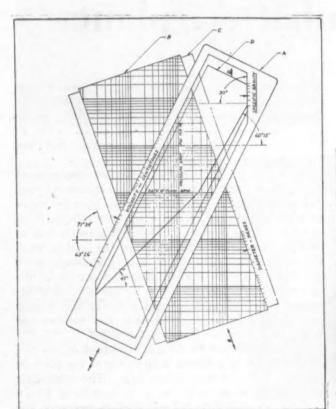


Fig. I-Schematic diagram of hydraulic system

- 1. Filter
- 2. Reservoir
- Suction disconnect coupling
- Engine driven pump
- 5. Pressure disconnect coupling
- 7. Main circuit pressure gage
- 8. Main eircuit accumulator
- 9. Emergency brake shutoff valve
- 10. Power brake valves
- 11. System relief valve 12. Brake circuit check valve
- 13. Emergency brake valves 14. Brake shuttle valves
- 15. Brake circuit pressure gage
- 16. Brake circuit accumulator return
- 17. Landing gear check valve 18. Landing gear selector

valve

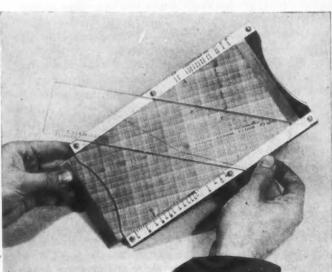
- 19. Main gear cylinders
- 20. Main gear shuttle valves
- Tail wheel cylinder
- 22. Wing flap return check

re

- 23. Wing flan selector valve
- 24. Wing flap restrictors 25. Wing flap pressure
- check valve Wing flap cylinder
- 27. Bomb door return check valve
- 28, Bomb door selector valve
- 29. Bomb door close shuttle valves
- 30. Bomb door open shuttle valves
- 31. Bomb door cylinders
- 32. Hand pump
- Emergency circuit re-lief valve 33.
- 34. Emergency selector
- valve Emergency circuit check valve

is depended upon to actuate a service requiring a high rate of flow for a short duration; the rate of flow being greater than the output of the pump. In other installations the accumulator is depended upon to actuate a service on the ground when the engine is cut off, as, for example, the bomb doors on the Liberator. In such cases, the size of the accumulator depends upon the service which must be performed. On this airplane, however, the purpose of the main circuit accumulator is only to act as a surge chamber

Fig. 2—A schematic representation of pressure drop calculator evolved from graphing P-F curves. D is a transparent plastic sheet on the back of Fig. 2-A schematic representation of which is etched a line having the slopes of the P-F curve. This sheet slides in a groove cut in the carrier plate A. An index mark on D lines up with a specific gravity scale on A. The carrier plate A moves in guides on the base plate C. An index mark on C lines up with a viscosity scale on A. B is a plate on which is printed a logarithmic chart graduated in pressure drop and rate of flow as indicated. B slides in a groove cut in the base plate C. An index mark on B lines up with a diameter scale on C. Double arrows show directions in which slides are constrained to move



and to prevent too frequent operation of the pressure regulator due to leakage in the system.

The main system relief valve has a dual purpose. It maintains the pump output pressure within safe limits in the event the pressure regulator fails to operate, and it relieves excessive pressures in the entire hydraulic system which may result from thermal expansion. The relief valve must be tightly shut at normal operating pressures, up to 1550 psi. It must open and pass the rated flow at the system relief pressure of 1800 psi. The size of the relief valve depends upon the maximum output of the pump. The relief pressure of 1800 psi designs much of the structure of the airplane since this is the limiting pressure which may be achieved at the actuating cylinders. One of the disadvantages of the pressure regulator type of system lies in the fact that the hydraulic system and the operating mechanisms must be heavy enough to withstand the 1800 psi relief pressure while the minimum operating pressure must be figured at 1250 psi.

Emergency Circuit

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The emergency hand pump provides an auxiliary source of power in the event that the main circuit ceases to function. In addition, separate circuits are provided from the hand pump to those cylinders which perform the services which are considered most essential to the safety of the airplane and the pilot. In this case these are: lowering the landing gear, opening the bomb doors, and closing the bomb doors.

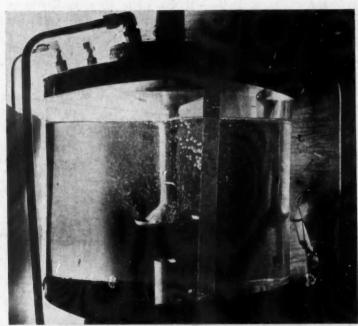
The hand pump is a double-acting piston pump. It draws fluid only on the up stroke and pumps out half the volume on the up stroke and half on the down stroke. For satisfactory operation of the hand pump the pressure at the suction port must not be less than 10 psi absolute with the pump operating at 45 cycles per minute at the maximum altitude and minimum temperature at which an emergency service might be required.

The function of the emergency selector valve is to direct the flow from the hand pump to any of the circuits directly connected for emergency operation, or to the

main circuit. To safeguard the main circuit from loss of fluid in the event of a failure in the emergency circuit, a check valve is placed in the line between the hand pump and the main circuit, permitting flow only from the hand pump to the main circuit, and checking it in the reverse direction. To prevent building up excessive pressure by the hand pump during emergency operation of any of the circuits, a small rinef valve is included in the emergency hand pump pressure line. Shuttle valves are placed at all cylinder ports and brake ports, where lines meet from the main and the emergency circuits. The shuttle valve permits flow to the cylinder from either the normal pressure source, or from the emergency source, and shuts off the non-operating source. Since during emergency operation means must be provided to permit free flow from the opposite cylinder port, the main selector valve must be set in the same operating position as the emergency selector valve, which is placarded accordingly.

Circuit Calculations

Thus far we have discussed the type and capacity of the power source. The next step was to design the operating circuits. The size of the actuating cylinders are dependent upon the peak load and the length of stroke required, but the size of the lines, valves, restrictors, etc., are a function of the timing requirements. For example, a cylinder having an effective area of 10 sq in. will exert a force of 15,000 lb under an operating pressure of 1500 psi regardless of the length and size of the lines or the capacity of the



The effect of flow characteristics on air elimination and circulation for cooling is observed in this plastic reservoir, which is a reproduction of the metal reservoir to be used in the prototype airplane

selector valve. However, the time required for this cylinder to move through a stroke of 10 in. will depend upon the resistance to flow of the lines and units through which fluid must pass.

In designing an operating circuit, it is desirable to prepare a load curve, showing pressure versus cylinder travel. With the load curve, the cylinder diameter can be selected from the peak load, a design factor, and the operating pressure.

Circuits may be placed in several categories according to the method by which timing calculations are performed. Three of these categories, which are most common, were required for the solution of the problems in this installation. They are: (a) Constant flow type; where the cylinder absorbs the full rate of output of the pump. (b) Constant pressure type;

(Turn to page 66, please)

Trends

HE subject of aircraft engine development past and future, was dealt with in remarkable length in the 32nd Wilbur Wright Memorial Lecture given recently in London before the Royal Aeronautical Society by Sir Fedden, president-Roy elect of the Society and until about a year ago chief engineer of the Bristol Aeroplane Co. for over 30 years and who was largely responsible for the development of the Bristol single sleeve valve aircooled engine now widely used on British warplanes. The lecture as printed has been termed a "stupen-

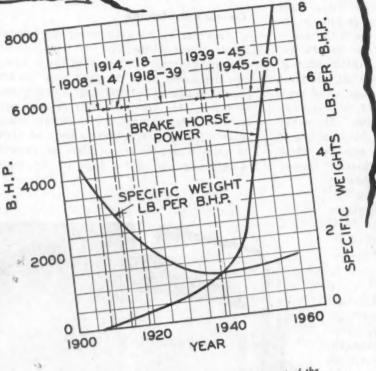


Fig. 1—Chart showing the progressive development of the average power and specific weight of aircraft engines during the past 30-40 years, the curves being extrapolated to indicate probable further development up to 1960.

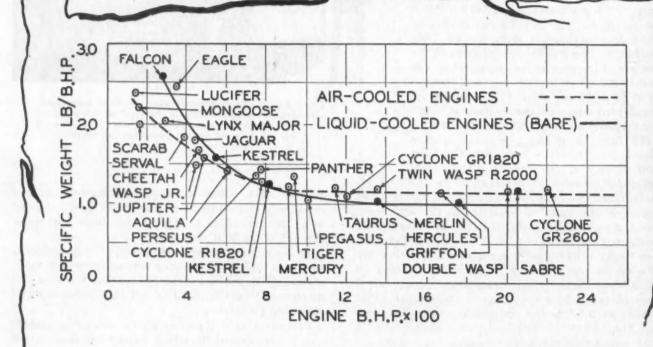


Fig. 2—Trends of specific weights of British and American air-cooled and liquid-cooled aircraft engines in bare condition and excluding cooling equipment and coolant of latter engines. The chart indicates that for units of over 1000 hp, there is little reduction in specific weight.

in the development of Aircraft Engines

Sir Roy Fedden, in Wilbur Wright Memorial Lecture Given before Royal Aeronautical Society, Foresees Gradual Decline of Reciprocating Engine in Favor of Gas Turbine for Airplanes

By M. W. Bourdon

Special Correspondent of Automotive and Aviation Industries in Great Britain

dous" review, and in delivering it Sir Roy was compelled to read a much abbreviated version. Hence this article is devoted to a summary of his views as to the lines and limitations of development of the recipro-

cating piston-type power plant in the near future, assuming the latter to extend to about 1960. A few years prior to 1960 Sir Roy anticipates the gradual decline of the reciprocating engine for aircraft in favor of the gas turbine. For that reason he considers that designers and manufacturers of the reciprocating type should plan its development for a reasonable short-term policy, and he suggests that the most promising procedure would be to take a developed form of a proven type of cylinder, possibly of somewhat increased bore, and design this round a crankshaft or crankshafts in a geometric form that has been proved already to be satisfactory. The latest liquid-cooled engine to come into production, Sir Roy points out, is the Rolls Royce Griffon, and the increase in its power over the Merlin has been achieved by retaining the same number of cylinders and layout, but with an increase of cylinder size.

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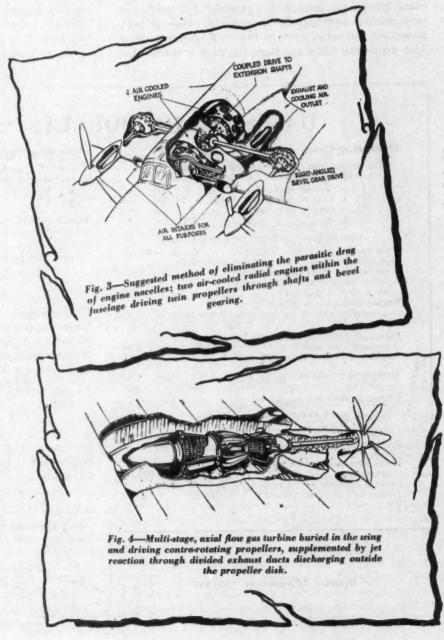
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The potentialities of the single sleeve valve, he said, have not been exhausted yet and no doubt sleeve valves can operate successfully with larger cylinders. Bores of 6.5 in. for aircooled cylinders and 7.5 in. for liquid-cooled cylinders should, in fact, be quite possible, giving outputs in excess of 200 hp for the liquid-cooled cylinder. About the same ouput per cylinder is also likely to be achieved with smaller cylinders on high octane fuel.

At this point Fedden referred to the chart (Fig. 1), with curves extrapolated on what he thought was a reasonable basis, indicating that by 1960 we may ex(Turn to page 116, please)



Douglas and Martin Postwar

NGINEERING data have been released on two feederline aircraft-the Douglas "Skybus" and the Martin 202 model-both of which have been designed for the postwar market. The Skybus, a twinengined, all metal, high-wing transport for 24 passengers and cargo, is equipped with a completely retractable tricycle landing gear and steerable nose wheel. Extreme maneuverability in the air and on the ground, plus ability to take off and land on small airports, are among the features engineered into this airplane. Two wide, truck-bed-level doors, an adjustable bulk head in the cabin, large baggage racks and many other new features are provided for quick and easy loading and to make possible its use for both passenger and cargo work as the traffic needs develop. Just inside the cabin are large baggage racks so that

passengers may deposit luggage upon entering, and have access to it in flight without assistance from the crew. A hat rack over the seats accommodates light

The engineering study and description of this Douglas airplane are developed around two 700 hp engines. fuel capacity of 300 gallons, and an operating range of 600 miles. At maximum take-off gross weight of 17,300 lb, a cruising speed of 190 mph at 5000 ft on 60 per cent rated power is maintained. Better than 11,000 ft altitude may be maintained with one engine out. The stalling speed is less than 65 mph. The airplane complies with all present civil aeronautics authority safety regulations and requirements, it is stated.

Basic Martin models are the 202-11 and 202-12, low

DATA ON THE DOUGLAS "SKY BUS"

\$42.10

Operating Costs

For the purpose of studying operating expenditures,

C_n	=	Cost of airplane	\$63,300
Ce	=	Cost of engines (2)	14,000
Cpr	=	Cost of propellers (2)	3,000
C	-	Total cost of airplane	\$80,300

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Direct Operating Costs (Dollars per hour	r):	
Crew cost\$11.20 Cost of fuel and oil—gallons of fuel consumed	=	\$11.20
per hour × \$0.17 per gallon	=	10.50
$65 \times 10^{-6} \times (C_a + C_{\mu F})$. Engine maintenance 0.28 \times	=	4.35
√ rated power × per cent rated power used	=	2.65
100		
Passenger insurance (assumed \$0.10 per		
passenger per hour)	=	2.40
Airplane insurance 40 × 10 ⁻⁴ × C	22	3.25
Airplane depreciation C _a 15,000	=	4.52
C.		
Engine depreciation $\frac{C_0}{3000}$ ×		
per cent rated power used		
100	-	2.80
Propeller depreciation $\frac{C_{pr}}{5000}$	=	0.70

Operating Specifications

Engines ... Two with 700 hp. for Take-off, 600 hp. Rated

Power for operation, 60 per cent rated

Maximum take-off weight-limited by take-off climb.....

Maximum take-off weight—limited by available take-off field length of 2000 ft.—13,930 lb. 2500 ft.-15.130 lb.

3000 ft.—16,030 lb. 3500 ft.—16,760 lb. 3500 ft.—17,300 lb.

Weight empty-24 passenger arrangement....10,680 lb.

Weight of trapped fuel and oil 80 lb.

True airspeed at 5000 ft. of 60

per cent rated power at take-off

15,130 lb.—192 mph. 16,030 lb.—191 mph. 16,760 lb.—190 mph. 17,300 lb.—189 mph.

Fuel reserve 0.20 × fuel for range + fuel for 45 min.

Oil capacity...... 20 gal.

- 57 ft 2in. Wing Span 86 ft. 7in Fuselage - Max Wiath 98 in 0000 - 60in.

Douglas 24-passenger "Skybus"

Total, when above data are substituted into

Payload capacity = 24 passengers and 120 cubic feet of cargo volume 6500 lb.

equations.

Planes for Feeder Lines

High wing version of the Martin 202 model

and high wing versions, respectively, designed around the Wright R-2600 engine, with the 202-15 similar to the 202-11, but designed around the Pratt & Whitney R-2800 engine, offering a somewhat higher gross takeoff weight and one engine operational ceiling with approximately the same ratio of useful load to normal gross weight. All three of these versions are designed to meet all requirements for an ATA-A1 airplane except the size of airport from which they must operate. Here it was found that the most economical airplane had a wing loading which required a 3250 ft airport at sea level. However, with a slight decrease in wing loading, the 3000 ft airport requirement can be met with a very small change in operating cost. Furthermore, four additional designs provide high and low wing versions to operate from 2900 and 2500 ft runways, although at some sacrifice in overall economy.

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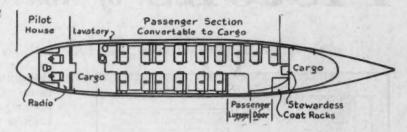
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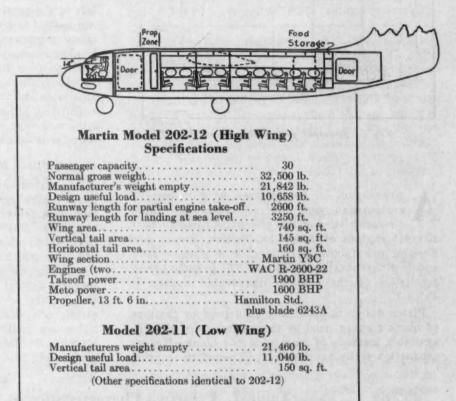
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A 30-passenger airplane was chosen as the most likely size for an A-1 transport, but general design parameters and features would remain the same should a smaller airplane be desired. Likewise, while all models except the 202-15 were de-

signed around the Wright R-2600 engine, any one can be modified to take the Pratt and Whitney R-2800 according to operator preference.

From the standpoint of speed and economy the Model 202 with a wing loading of 44 psf has a high efficiency. This airplane will cruise at 250 mph at 10,000 ft and 60 per cent power. Both high and low wing versions are offered at each wing loading. The high wing airplane appears to present certain advantages such as passenger visibility, ease of loading and unloading, and reduced ground time, whereas the low wing airplane offers others such as a shorter landing gear and reduced weight empty. To make the high wing version safe in belly landings 200 lb of structure has been added in the form of longitudinal beams in the bottom of the fuselage, while heavy bulkheads are included under each spar to support the wing in



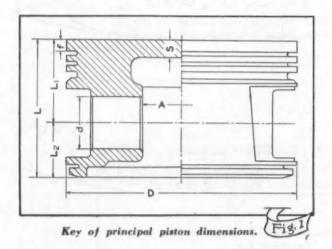


the advent of a crash landing. The net result is a 382 lb greater weight for the high wing version, amounting to 3.85 per cent of payload plus fuel plus oil. Offsetting this, the high wing airplane will cruise 4 miles per hour faster because of its smaller fuselage frontal area.

Cabins of all Martin versions are convertible to passenger, cargo or combined passenger cargo operation and are equipped with a movable bulkhead utilizing standard loading gear fittings. Seats are so designed that for cargo operation seat backs may be hung on the fuselage wall, acting as a protective padding while seat cushions are stored in overhead luggage racks. Hatches on all versions are below truck level to simplify loading. Two interior arrangements for passenger service are offered, one with all seats fac-

(Turn to page 102, please)

Pistons of American, British, French



COMPARISON of the geometry, weight, material composition, unit power loading and other characteristics of the pistons in some military aircraft engines of American, British, French and Russian manufacture permits an evaluation of some widely different types of designs. The principal characteristics of the engines represented appear in Table 1.

Piston design is materially influenced by the type of blank forging used in the manufacture and the available methods of machining the blank. Modern production technique is chiefly directed to securing the optimum balance between the technical requirements of strength and durability, and simplicity and economy of manufacture. In all modern aircraft engines forged or pressed piston blanks are used. The maximum reduction in weight is then only possible by machining away the material accumulations left in the production of the blank. Besides requiring special tooling, this procedure also increases the labor component, having a decisive effect on the total production time. Consequently, there is a natural tendency to sacrifice extreme weight saving for simplicity in manufacture, in order to be able to cope with the increased output required by wartime conditions, although some, in particular the British, have not departed from their traditional and elab orate production methods.

British Piston Designs

The piston of the well-known Bristol Mercury XII poppet-valve engine differs greatly in design and materials from the standard types of other manufacturers. The principal feature is the use of a particularly short, compact, and consequently rigid piston, in which lightness of construction is obtained by cutting away material in the form of external recesses around the piston pin bearings. An essential feature is the closest possible spacing of the piston pin bearings. The possibility of milling lightening pockets has been extremely used, giving a typical Bristol piston design. This piston, with its extensively milled interior, may be considered as

Table 1. Principal Characteristics of Engines

	ENGINE	Cylinder			Take-Off		Number		
Maker	Model	Diameter D(mm)	Stroke (mm)	Displacement (liters)	Performance NeHP	RPM	of Cylinders	Engine Type	Coolant
BRITAIN Bristol Bristol Bristol Bristol Rolls-Royce Rolls-Royce Rolls-Royce Rolls-Royce	Perseus XII Taurus II Hercules X Kestrel Perogrine Merlin XX Vulture II	146 127 146 127 127 137, 2 127	165 137 165 139.7 139.7 152.4 139.7	25 24.4 38.7 21.25 21.25 27.42.5	890 1075 1500 745 875 1300 2000	2750 3225 2800 3200 3200 3000 3200	9 14 14 12 12 12 24	Radial sleeve valve Twin radial sleeve valve Twin radial sleeve valve Upright vee (60°) Upright vee (60°) Upright vee (60°) X-type (90°)	Air Air Air Liquid Liquid Liquid Liquid
U. S. A. Pratt & Whitney. Wright. Wright. Allison.	Twin Wasp. Cyclone G 205. Double-Row Cyclone GR2600 V1710-C15.	139.7 155.6 155.6 139.7	139.7 174.6 174.6 152.4	30 29.9 42 28	1220 1200 1620 1150	2700 2500 2400 3000	14 9 14 12	Twin radial Radial Twin Radial Upright vee (60°)	Air Air Air Liquid
FRANCE Gnome & Rhone Hispano-Suiza Hispano-Suiza	14K 14AB-10 12Yors.	146 135 150	165 130 170	38.7 26.1 36.1	1160 680 890	2600 2400 2400	14 14 12	Twin radial	Air Air Liquid
RUSSIA Russia Russia Russia	AM38	160 148 146	190 170 165	46.6 35.2 38.7	1490 1100 1100	2150 2600 2600	12 12 14	Upright vee (60°) Upright vee (60°) Twin radial	Liquid Liquid Air

and Russian Aircraft Engines

An analysis and comparative data presenting the results of an exhaustive study made in Germany

representing the highest development both in design and production, even if at the cost of a disproportionately high expenditure of time and labor.

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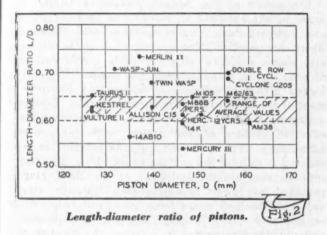
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The Bristol Taurus II piston shows the same principal features as the Mercury type. The use of the Burt-McCollum sleeve valve imposes a characteristic external form, particularly in the ring zone, consisting in a lengthening of the top land, making the



piston somewhat topheavy. Since the upper gas ring must be positioned so as not to pass beyond the lower edge of the sleeve port, the result is to remove this ring further from the piston crown rim and create more favorable conditions of running and heat transfer for this and the succeedingrings.

The Bristol Perseus XII piston shows the same characteristic features of the sleeve valve engine piston. The piston of the Bristol Hercules X has the same dimensions and design details as the Perseus, with the exception of a larger piston pin. The ring arrangement is essentially the same in all three Bristol pistons-two chamfered gas, rings and a double oil-scraper ring above

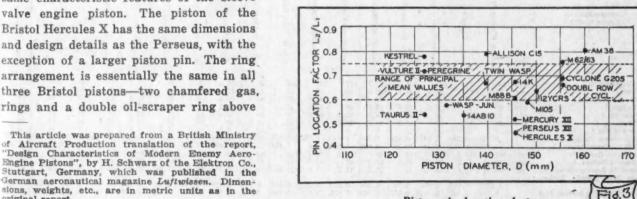
the piston pin, with a further scraper ring on the end of the skirt to assist in spreading the lubricating oil.

The Rolls Royce Kestrel engine, which is still in use for training purposes, can be regarded as the prototype of the engines now in service. The Kestrel piston, while displaying all the typical features of British practice, differs in some essentials from the Bristol pistons. The rough stock is here again a forged blank only very roughly approximating the final form, which, with the external lightening pockets, is produced by overall machining using ordinary milling methods with ordinary tools, however. The development of the external lightening pockets is considerably affected by the use of a standard piston boss spacing providing an adequate piston pin bearing surface.

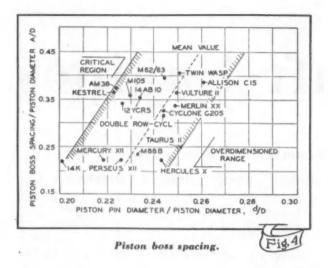
The piston of the larger Rolls Royce Merlin X engine is of essentially the same design and shows the same methods of manufacture. The most marked departure is the provision of a greatly lengthened skirt in the form of an unsupported bearing ring. which ensures a better distribution of the lateral bearing pressure and considerably reduces its peak value. The pistons of the Rolls Royce Peregrine and Vulture models are externally identical and very similar to the Kestrel model. The modifications tried and tested on the similar Merlin piston have in great part been transferred to the smaller piston design, with the exception of the lengthening of the skirt.

Summarizing the British designs considered, the

Piston pin location factor.



original report.



requirements of lightness and rigidity have been fulfilled apparently without regard to economy of manufacture, milling methods being widely used.

American Pistons

In American piston designs, economy in manufacture takes a prominent place. The blanks are formed by direct press-forging, including the particular form of crown reinforcement adopted. This entails the exclusive use of substantial and somewhat heavy, full-skirted piston types. Additional machining is avoided wherever possible, but in the pistons of larger diameter it becomes unavoidable for lightening purposes.

The piston of the Pratt & Whitney Twin Wasp engine has a strong and compact full-skirted trunk piston designed primarily to meet American requirements for production economy, machining being reduced to a minimum. The rough blank is pressforged, the inside features, including the high and narrow reinforcing webs of the crown, being shaped

in the same operation. Machining of the interior is thus confined to turning down the skirt, which is done by a process of gang-milling leaving narrow stiffening fins which give the skirt the necessary rigidity in bending and improve the bearing on the cylinder walls. The machining method used requires fairly widely spaced piston bosses and consequently a long, strong, and therefore heavy piston pin. The reduction in machining work in the interest of rapidity of production slightly increases the weight.

Particularly interesting in the interior construction of the Wright Cyclone G-205 listed is the provision of 57 closely-spaced, long, conical cooling studs over the surface of the crown, replacing the cellular reinforcement of the preceding model. These studs considerably increase the effective surface of the crown, resulting in increased heat transfer to the cooling oil and the air in the crankcase. This device has not hitherto been used in any other engine. Although the interior of the piston is already press-forged to the final shape, an extensive amount of machining is required, owing to the close spacing of the bosses, to lighten the piston sufficiently.

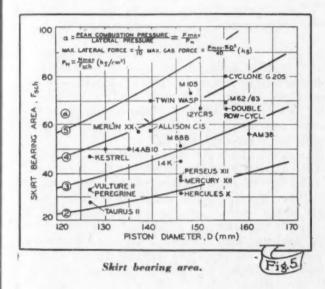
The piston of the Allison V1710-C15 engine is again of the substantial, full-skirted type, of short and compact design by comparison with standard American practice. The development of the design also shows preferential attention to considerations of economy in manufacture. The completely pressforged piston has the usual honeycomb reinforcement of the crown found in Wright engines. Besides acting as a reinforcement, these ribs increase the effective surface of the crown, with consequent advantages. The machining of the interior is restricted to milling the surface of the skirt. The ring zone is very simply designed; of the three rings provided, the lowest is a bevel-faced spreader ring, any additional oil drain from this point being dispensed with. This hitherto unusual simplification undoubtedly also serves to increase the rigidity of the piston, but is capable of application only to inline engines with upright cylinders.

Table 2. Principal Dimensions of Pistons (See Fig. 1)

				E	BRITAIN	1			U. S. A.				FRANCE			U. S. S. R.		
Dimension or Characteristic and Engine Model	Unit	Bristol Mercury XII	Bristol Taurus II	Bristol Persous XII	Bristol Hercules X	Rolls-Royce Merlin XX	Rolle-Royce Kestrel	Rolls-Royce Vulture II	P. & W. Twin Wasp	Allison V1710-C15	Wright Cyclone G-205	Wright Double-Row C.	Hispano-Suiza 12 Yers	Hispano-Suiza 14AB10	Gnome-Rhone 14K	M 88 B	M 105	AM 38
Pi. ton Diameter, D. Total Length, L. Compression: Height; L. Skirt Length, L. Boss Spacing, A. Boss Diameter, d. Top Land Width, f. Length/Diameter Ratio, L/D. Piston Pin Lecation Ratio L/Ls. Area of Piston Grown, F. Skirt Bearing Surface, F. Rolative Skirt Bearing Surface, F. Rolative Skirt Bearing Surface, F. Rolative Skirt Bearing Surface, F.	mm mm mm mm mm mm cm ² cm ²	146 79 52 27 32 32 7.2 0.542 1.926 167 37.15 19.35	127 83 64 29 32 32 15 0.654 1.862 126.2 27.5 18.6	167 38.55 18.45	146 89.5 61 28.5 32 35.5 20 0.613 2.14 167 31.7 22	137.3 100.6 48.35 52.25 46.8 34.2 7 0.735 0.925 148 57.1 21.2	127 80 45 35 46.5 28.5 8 0.63 1.286 126.2 47 15.7	127 79 45.9 32.8 46.5 31.7 7 0.622 1.4 126.2 33.3 17.1	140 95 57 38 58 35 10 0.678 1.522 153 70 23.8	140 88 49 39 54 36.5 13 0.63 1.256 153 57.5 19.7	155.6 107 63.5 43.5 50.4 38 6.5 0.688 1.46 190 80 17.1	155.6 109 65.5 43.5 49 38 6.5 0.70 1.505 190 67 17.1	56 36 51.5 34 9.2 0.613	135 76 49.5 26.5 48 31.6 8.5 0.563 1.868 143 50.5 20.2	146 87 52 35 32 29.4 7 0.595 1.486 167 44.6 19.4		148 96 60 36 53 34 11 0.649 1.666 172 73.3	160 95.5 53 42.5 60 36 6.5 0.56 1.2 201 55.9
F _{Seh} /F Relative Pin Bearing Surface, F _B /F		0.2225	0.218		0.19	0.386	0.373		0.549	0.376		0.363	0.38	0.353 0.141	0.267		0.426	0.2

Table 3. Partial Weights and Weight Factors of Pistons and Accessories

		BRITAIN							U. S. A.				FRANCE			U. S. S. R.		
Dimension or Factor and Engine Model	Unit	Bristol Mercury XII	Bristol Taurus II	Bristol Persous XII	Bristol Hercules X	Rolls-Royce Merlin XX	Rolls-Royce Kestrel	Rolls-Royce Vulture II	P. & W. Twin Wasp	Allison V1710-C15	Wright Cyclone G-205	Wright Double Row Cyc.	Hispano-Suiza 12 Yers	Hispano-Suiza 14AB10	Gnome-Rhone 14K	W 88 B	M 105	AM 38
let Piston Weight, Go Iston Pin Weight, GB Veight of Rings, GR Veight of Pin Lock, GS quipped Piston Weight, Cl	(g) (g) (g) (g)	1496 398 205 15 2114	1317	1653 385 195 15 2248	1810 452 196 17 2475	1370 354 218 8 1950	987 231 119 6 1343	1080 317 181 6 1584	1744 505 213 50 2512	1677 348 186 20 2231	2338 540 250 26 3154	2262 620 250 24 3156	1587 437 185 30 2239	1162	1477 290 195 20 1982	1755	1835 489 208 28 2560	2336 772 260 48 3416
Go/Ne. quipped Weight of Piston, per HP, G ₁ /Ne. atio of Net/Equipped Weight.		16.1	17.1	16.7	16.9 23.1	12.6	15.9	12.9	20 28.9	17.5 23.2	17.6 23.7	19.6 27.3	21.4	24	17.8	22.3	20 27.9	18.8
of the Edulphed Weight, Go/G1. St Weight per Unit Volume, Go/D3.		0.708	0.643	0.736	0.731	0.705	0.733	0.681	0.695	0.718	0.74	0.718	0.712	0.473	0.745	0.562	0.717	0.6



French Piston Types

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The piston of the Hispano-Suiza liquid-cooled 12 Yers V-type engine continues the original practice of this firm in being of light and simple design. The features of the pistons in the later-developed Hispano air-cooled radial engines, such as the 14AB-10 twin-radial, are therefore of particular interest. The typical features are a short and narrow skirt; flat, unstiffened crown with normal spacing of the bosses; and a normal ring arrangement. This piston is simple and effective in design and suitably economical in manufacture, although the design appears unsuitable in its present form for higher stressing.

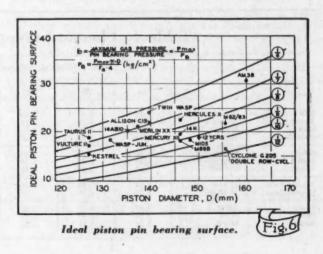
The piston of the Gnome & Rhone 14K twin-radial engine is obviously influenced by the British Bristol engine design, evidently as a consequence of the license rights acquired from the latter. The extent to which the internal finish has been carried, however, indicates either that the requisite tools and jigs were not available or that the licensee has not received full instructions for manufacture. The

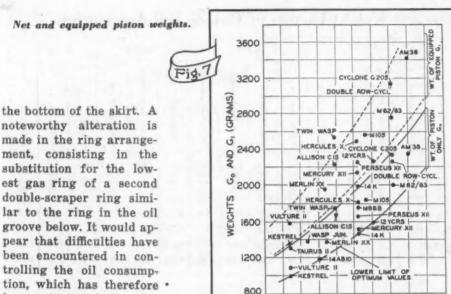
piston is thus produced with much toil and trouble without any of the corresponding advantages.

Soviet Russian Piston Types

Soviet Russian piston designs show different trends of development; this is probably due to the fact that the separate designs are developments of less highly loaded prototypes from other countries, reproduced under license. Certain special features, however, chiefly of American origin, are being increasingly applied generally, to the improvement of all the designs, bringing the level of development well up to that of other countries. Press-forging and subsequent treatment of the blank may already be considered as completely mastered in principle. Economy in manufacture is pursued as far as practicable, but suffers, necessarily, with increasing refinement of the designs, owing to the necessity for additional machining and finishing operations.

The M105 engine is a development of the French Hispano-Suiza 12 Yers with increased output. Its piston is consequently a close copy of the prototype. The principal characteristics are a relatively long, full skirt, and the omission of a scraper ring below piston pin level. A kind of reinforcement of the piston is attempted by leaving a reinforcing lip on





been attempted by this means.

Both in dimensions and in layout, the liquid-cooled AM38 V-engine is

a replica of the German BMW VI and IXa designs. The piston is interesting as representing a synthesis, principally of American, but also of French, British and original Russian design features. The substantially dimensioned piston appears somewhat heavy and clumsy but shows a clean and compact outline. The skirt is milled internally, leaving a reinforcing lip on the bottom. The economy in manufacture may be considered equal to that of the American prototypes.

The M88-B engine is a reproduction under license of the French Gnome & Rhone 14K, independently developed to some extent. The design again combines the characteristics of different national types; these, however, have been combined in a well-knit, compact and balanced design. Again, high quality in the design has caused concessions to be made in respect to the amount of additional machining.

Dimensional Comparisons

Table 2 shows the principal dimensions of the

various pistons under consideration, while Figs. 2 to 8 represent some of these items graphically for aid in comparison. Almost all the pistons examined, with the exception of the Rolls-Royce models and most particularly those with internal reinforcing ribs, show a uniform crown thickness along the diameter within the range of 7.0 to 11 mm (see S in Fig. 1). This would appear to entail heat concentration in the region of the rim, with a corresponding effect on heat conditions in the adjacent piston ring zone.

As shown in Fig. 2, the length-diameter ratio varies in most of the pistons examined within a

very restricted range of L/D = 0.60 to 0.65 only. Noteworthy deviations from this mean range are the exceptionally short Mercury piston and the exceptionally long Merlin piston. These divergent designs particularly well illustrate the influence of domed and dished crowns respectively.

The values of the piston pin location factor, L_a/L_a shown in Fig. 3, very clearly demonstrate the special position of the Bristol pistons which, with a value of $L_a/L_a = 0.5$, are exceptionally top-heavy, particularly in the sleeve valve engines. Pistons with a factor of $L_a/L_a > 0.8$ may be considered as of the long type particularly suitable for obtaining low bearing pressures on the skirt, but excluded from this consideration, however, on the score of excessive weight. The proportions of the Merlin piston are therefore a particular departure from standard practice.

The spacing of the piston pin bosses depends on the one hand on the permissible working stress on the little-end bearing, and on the other hand very much on the methods used in the manufacture and

Table 4. Chemical Composition of Piston Material

PISTON DIAMETER , D (mm)

100 0			CHEM	Temper and Age					
Builder	Mode I	Cu	NI	Mg	SI	Fe	Al	Hardness HB (kg/mm²)	Type of Material (German Standard)
Bristol	Perseus XII Taurus II Hercules X Vulture II	2.23 2.31 2.46 2.10	1.04 1.19 1.00 1.04	1.44 1.69 1.60 1.56	0.83 0.86 0.87 0.89	1.05 1.02 1.08 0.88	Rest Rest Rest	138/76 107/61 124/62-65 127/76	RR 59 RR 59 RR 59 RR 59 (< Fe)
Wright. Pratt & Whitney Allison	Cyclone C-205 Twin Wasp V1710-C15	4.04 1.46 1.02	2.03 0.92 0.94	0.59 1.19 1.16	0.36 12.53 12.57	0.31 0.43 0.42	Rest Rest Rest	115-121 131/97 120/73-76.5	Y-alloy (< Mg) Flw. 3211.9 (EC 124) Flw. 3211.9 (EC 124)
Hispano-Suiza	12 Yers	3.69 4.50	1.58 2.10	0.66 1.51	0.50 0.35	0.20 0.44	Rest Rest	115/62,5 120-132	Y-alloy (< Mg) Y-alloy
Russia	AM38	2.47 3.84 2.25	1.27 1.87 1.16	1.55 0.54 1.70	0.60 0.48 1.15	1.26 0.90 1.33	Rest Rest Rest	138/98-101 107/81-85 118/121	RR 59 Y-alloy (< Mg; > Fe RR 50



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RUCK HOUSINGSthe Test of Fine Steel

In Buchanan, Mich., the Clark Equipment Co. produces one-piece tubular forged truck housings-a great contribution to the truck industry, and proof of the uni-

Many thousands of these housings are made from Inland plates, which are first rolled into tubes, welded by the multi arc atomic hydrogen welding process, and formed by severe cold working as well as hot working operations. The housings are then heat treated, developing a higher yield point, and higher fatigue properties. These housings have great strength commensurate with

It takes uniform high quality steel to make truck housings this modern Clark way. That is why Inland steel was chosen-steel that is controlled step by step, from ore mines to finished product, by skilled technicians who daily make hundreds of tests and inspections. This job of checking and rechecking is so thorough that

We invite you to let our Inland men help you select the right steel for finer, stronger products and more economical fabrication, whether for war or for the

INLAND STEEL

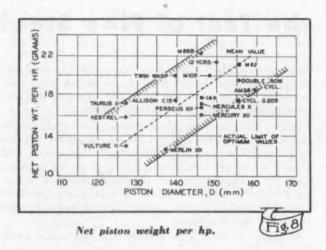
Table 5. Proportions and Characteristics of Piston Pins

ENGINE		Cyl.	PIN DIMENSIONS								CHARAG	CTERIST		
Builder	Model	Diam. D mm	d ₀	d ₁ mm	d ₂ mm	S	1 mm	a mm	b mm	1/D	GB* gram	W× em³	GB/W g/cm ³	Method of Locking
Bristol Bristol Bristol Rolls-Royce Rolls-Royce Rolls-Royce	Mercury XII Perseus XII Hercules X Kestrel Merlin XX Vulture II	146 148 146 127 137.3	31.7 32.98 35.57 28.5 34.28 31.74	17.2 19.2 21.25 20.0 23.9 21.55	22.7 27.5 30.0 22.5 29.4 25.5	7.3 6.9 7.1 4.25 5.2 5.1	106.3 104 104 103 111 102.8	18 24 64 13 45 58	44 40 20 45 33 22	1.728 0.713 0.713 0.813 0.81 0.81	398 385 452 230 354 317	2.86 3.11 3.57 1.72 3.00 2.47	139 123.5 126.5 133.5 118 128.5	External washer and wire clip External washer and wire clip External washer and wire clip Internal clip and locking sere Internal clip and locking sere Internal clip and locking sere
Wright	Cyclone G-205. Twin Wasp. V1710-C15	155.6 139.7 139.7	38.05 34.86 36.47	20.0 20.25 27.8	25.0 25.75 33.2	6.5 7.3 4.3	109 127.3 111.2	109 57 80	14/21 15.5	0.70 0.912 0.80	540 505 348	4.38 3.69 3.15	123.5 140.5 110.5	Internal spiral ring Al. Mushroom Internal wire and split ring
Gnome & Rhone	14K	146	29.5	20.0	23.5	4.8	113.2	49	32	0.775	290	1.98	146.5	External washer and wire clip
Russia	M105	148 160	34.0 36.0	20.0 17.65	25.5 22/28	7.0	108/138 147	58 51	24/16 28/20	0.933 0.919	489 772	3.38 4.32	144.5 178.5	Ai. Mushroom Ai. Mushroom

*-Weight of pin.

X—Equatorial moment of principal cross-section.

finishing of the piston, while the actual spacing of the bosses with the provision of possible lightening pockets in turn fixes the diameter of the pin. These relationships are shown in Fig. 4. Although there is considerable scattering, the basic design require-



ment of a linear increase in the pin diameter with boss spacing and piston diameter is clearly apparent. The figure also gives clear proof of the influence of production methods on the limitations and advantages of the various design possibilities, in which connection it is particularly interesting to note the sharp distinction between the full-skirted type most economical in manufacture and the open-skirted Bristol type of piston with lightening pockets entailing considerable complication in manufacture.

Fig. 5 shows the values of skirt bearing area. To enable an estimate of the resulting side thrust, widely-spaced lines have been plotted on the diagram for the parameter "a," representing the ratio of lateral bearing pressure, p_N , to peak combustion pressure, p_{max} , on the assumption that the side thrust

on the piston is 10 per cent of the maximum gas force acting on the piston head. The figure shows that in short, compact pistons the side thrust may amount to half the peak combustion pressure. Furthermore, with decreasing piston diameter the side thrust pressures increase, probably owing to the greater rigidity of smaller pistons. This would particularly benefit the well-stiffened Bristol Hercules piston in which, with a diameter of as much as 146 mm, the short and narrow working faces of the skirt have to support, on the basis of an assumed peak combustion pressure of 50 kg per sq cm, an exceptionally high side thrust pressure of 25 kg per sq cm. On the same assumptions, the skirt of the smaller Twin Wasp piston transmits a pressure of only 11 kg per sq cm.

Fig. 6 shows the ideal projected bearing surface of the piston pin in the two piston bosses. Auxiliary curves are similarly plotted for the parameter "b" representing the ratio of piston pin bearing pressure to peak combustion pressure. The figure shows that the pin bearing pressure under full load may amount to 6 to 10 times the peak combustion pressure. The geometrical proportions of the piston appear to have as little effect on the bearing pressure as the piston diameter. These factors become effective, however, in connection with the actual dimensioning of the (Turn to page 72, please)

Pin dimensions.

Molybdenum produces hardenability in cast steel economically because it lends itself well to close analysis control-and recoveries from scrap are high.



DATA ON MOLYBDENUM APPLICATIONS.



FERROMOLYBDENUM . "CALCIUM MOLYBDATE"

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Robot Bombs

Shorn of its horror aspect the German robot bomb is a most interesting piece of mechanism and certain of its features will probably find their way, modified, of course, into future civilian aircraft. The robot, being expendable, had to be fitted with automatic controls and propelling units which were reliable and cheap—both prime requisites for all apparatus to be used in low cost aircraft.

The robot has a directional gyro and a fore and aft control gyro as well as an automatic altitude control. These controls may form the basis for the design of cheap units for small aircraft of the type which we may be able to buy after the war and may take much of the tension and hazard out of flying, especially on long runs. The lateral control, however, seems to be taken care of by dihedral and this has been used in some small European planes, although it is not particularly comfortable in the air in rough weather and leaves a lot to be desired when flying near the ground on landings and take-

The propulsion unit is a marvel of simplicity to those who did not read the description of the robot's engine in the August 1st AUTOMOTIVE AND AVIA-TION INDUSTRIES I might say that its engine is just about as simple, being a combustion box with a propulsion jet tube extending out of the back and an unbalanced shutter valve in the front. As the robot goes through the air it opens the valve, some fuel spray is injected into the box, ignited and explodes; the valve closes and the reaction force from the gases shooting out of the tube propels the robot. As the pressure drops, the force of the air on the outside of the valve opens it, scavenging the box and another shot of fuel is fired in it. In its present form the set-up is probably rather wasteful of fuel, but so is the outboard engine and yet hundreds of thousands of them are running and giving lots of people a great deal of pleasure. It may be that this German idea can be ironed out and some day make a simple, cheap propulsion unit for small planes. I have always contended that, some day, we are going back to catapult take-offs and this would work to perfection with the robot type engine.

You know, the fact is that the first

airplane to fly took off of a track and planes were only fitted with wheels in the beginning so that they could take off of any field, thus saving the work of carrying the Wright launching apparatus around and setting it up for every new take-off location. In fact, one of the requirements for early military aircraft was the ability to take off of and land in a ploughed field. As wing loadings have risen, landing and take-off speeds have risen, too, and are now at the point in most airplanes that any landing off of a prepared landing strip means a crash. It also means that the plane has to take an enormously long run to get flying speed and that fantastic amounts of energy have to be absorbed by the brakes on landing. All of this adds up to some assisted take-off such as a catapult rig and some means of landing other than wheels and brakes.

Valve Gears

The smaller aviation engines have been introducing a feature-hydraulic valve lifters-which will eliminate much of the maintenance grief in aircraft engines. In the old days of open rocker arms, the constant inspection of rocker arm clearances was a nuisance, especially when it had to be done with the engine "hot," which meant that the first to be inspected were checked with the engine really hot and the last with it almost cold. When the rocker arms were enclosed the job became a real nuisance for the small plane owner and is no particular joy for the commercial operator, as it is a messy job which takes lots of time and care and new rocker box lid gaskets every few operating hours.

The hydraulic tappet insures the engine being timed as designed to be and eliminates a lot of clatter. I have driven a 12-cylinder motor car equipped with them for over 37,000 miles and had just one stuck tappet which was cleared in a couple of minutes by filling the crankcase with flushing oil and "unsticking" it. I have also used a number of light aircraft engines in some special boats which I have been building for the Government so fitted and they are a joy. There are probably other means of accomplishing the same thing and I certainly advise every designer and builder of engines to use some such scheme and get away from uncertain rocker arm adjustments.

Noise

If I were to talk about mufflers everyone would say that it had been thought of a thousand times but was one of those good ideas which do not work. Many will also tell you that the prop makes much more noise than the en-I have been doing some work along the New Jersey coast and the blimos pass back and forth all day long. Their engines are muffled by the condensers which recover the water produced by the combustion in the engine in order to get ballast to make up for the weight of the fuel burned. These "bags" almost "ghost" along and it is certain that if airplanes are going to be used in large numbers over or near centers of population, they, too, will have to be muffled. I can remember the day when all motor cars had a "cut out" and all of the young bloods liked to roar down the road at about 40 mph. sounding like a hundred, but try and do it now!

Insurance

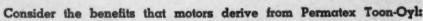
Airbriefs has, from time to time, tried to point out certain things which might tend to limit the market for airplanes in the postwar period. We have talked about the lack of landing fields, Government restrictions and even the necessity for some radical idea in airplanes which will make them so easy and safe to operate that the average man will be a prospect.

Let us imagine then that everything we hope for has happened and that the industry is ready to go into production on the new MARVELPLANE. Our customers have read the publicity and are ready to put the name on the dotted line when someone coyly remarks: "That's all right, but what will happen to your insurance?" Right then and there the new industry will be on a snag of the first magnitude!

If you read your average insurance policy you will find that private flying is out and that the company isn't too enthusiastic about regular and frequent flights over established commercial routes in spite of the fact that planes on regular runs have proved very safe and even private planes are not sending more men to their graves than the war is, although the basically very safe motor car is through its misuse. The same insurance companies which tremble at the thought of aircraft don't bat an eyelash at the motor car.

Car insurance against injury to third parties is available at a most reasonable figure, but try to get similar insurance on your private plane. This alone will cost about as much as the average young man could afford for his flying budget. If airplane clubs were organized to handle insurance as motor clubs do, rates could be reduced to a reasonable figure.





Carbon-gum deposits are removed without clogging oil

The resistance of oil films to pressure is greatly increased and therefore all lubricated parts obtain greater protection.

Sludge and acid formation are greatly decreased and therefore all metal parts, particularly bearings, last longer.

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Send for Manual . . . "Three Products in One". Gives much useful information.

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Immense 4-high hot mill rolls slabs into aluminum alloy sheets ready for fabrication

ROM bauxite to bomber—that's the slogan symbolic of the integrated facilities of the Reynolds Metals Co. Starting from scratch 25 years ago in what has mushroomed to be Plant 1 in Louisville, Ky., the company and its subsidiaries operate 40 plants in 13 states. One of its plants—Listerville, Alabama—is said to be the only one in this country producing finished aluminum right where bauxite is refined. Almost literally out of the ground into the sky.

For the purpose of this study, our interest lies in the link between the production of aluminum sheet, bars, rods, extruded shapes, etc., and the fabrication of these into finished parts ready for assembly into airframes and other structures.

This was the basic plan introduced four years ago—before Pearl Harbor—as a special service for the overburdened aircraft assembly plants.

bacco leaf storage; one of the larger units occupies a new Mengel

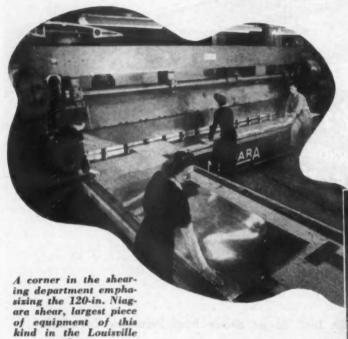
plant originally built for the production of laminated plywood airframes.

The philosophy behind the fabrication setup is worthy of comment not only because of its immense value during the War but for its implications for postwar operations. The Reynolds plan, designed to eliminate five principal bottlenecks on a national scale, releases skilled labor in assembly plants to the vital job of speeding up assembly operations. The following advantages are claimed for the plan:

1. Manpower—releasing manpower for critical operations

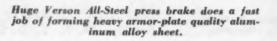
2. Floor space—releasing for assembly entire departments formerly devoted to fabrication

3. Transportation and scrap — relieving transportation facilities by reducing the number of freight cars required to carry scrap metal from the fabrication plant back to the mill. Approximately 30 per cent of aluminum sheet becomes scrap in the normal fabrication

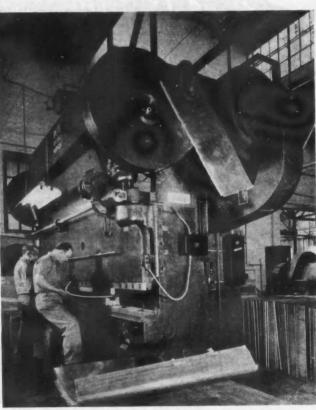


Under this plan, finished aluminum parts are fabricated to customers' drawings and specifications—at the very source of aluminum sheet. From its modest beginnings, this fabrication service has now expanded into three large Reynolds plants located in Louisville, and three additional plants in and near that city whose entire output has been contracted during the war. Some of the plants occupy space formerly used for to-

plant.



Reynolds





Aluminum Fabrication

process. By the
Reynolds method,
the scrap produced in its fabricating plants
is properly segregated and
reconverted into useful aluminum in a matter of hours

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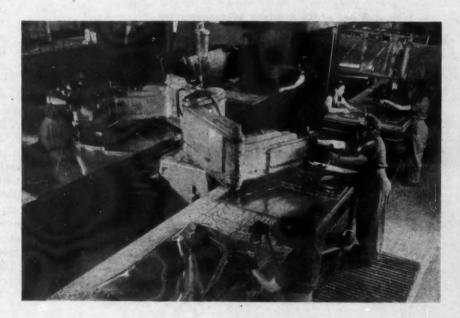
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4. Tools — saving tool expense and relieving tooling facilities. Where several plants use the same parts, these parts are produced from a single set of tools

5. Time — Aluminum parts are packed, inspected, and ready for assembly without further process.

The scrap feature alone deserves special attention since Service organized on large scale basis and will be offered to postwar trade

By Joseph Geschelin



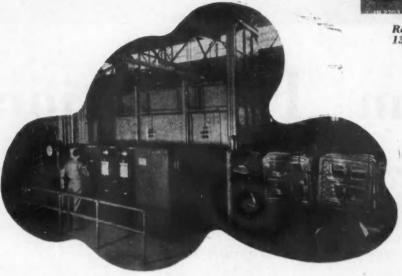
Small corner of the routing gallery. Here are a few units of various types of routers, showing form cutting and drilling operations.



View in the drop hammer department showing part of a battery of Chambersburg Cecostamp hammers. This equipment is used for deep drawing operations.



Reminiscent of motor car production is this 1300-ton Hamilton press formerly used in a busy Fisher Body plant.



View of one of the Lindberg heat treating furnaces showing a charge ready to enter the heating chamber. This unit is equipped with an automatic quenching station.

stamping and blanking operations normally produce scrap that averages around 30 per cent. In a unified facility some of the scrap is gainfully employed in the fabrication of many small parts, the rest is immediately remelted and converted in the company's reclamation plant and rolling mills in the same city into aluminum sheet ready for further fabrication. Segregation of scrap is another feature. Normally a great deal of valuable tonnage is rendered worthless due to difficulty of segregation in the user's plant. Here the different alloys are carefully segregated, kept clean and uncontaminated, hence 100 per cent convertible.

For its postwar operations Reynolds intends to continue the fabrication service described in this article. However, with the changing picture of industrial activity visualized in the immediate postwar period, it is expected that its scope will be extended to serve a larger area of automotive customers. For example, with the anticipated expansion of use of aluminum in motor cars, motor trucks, buses, etc., Reynolds will be ready to produce all manner of fabricated parts, heavy stampings, small stampings, forgings, to the smaller manufacturers and all others who will find it more expedient and more economical to utilize the existing facilities and the specialized know-how of

an organization whose wartime records of service has been so exceptional.

Louisville Plant 12 comprises six different buildings formerly used for warehousing tobacco. Functionally this plant has been developed along the following departmental lines:

Routing, drilling, burring, inspection, anodizing Tool and die departments, hand forming

Hydro presses, inspection, packing

Punch press department, heat treating, chromic dip

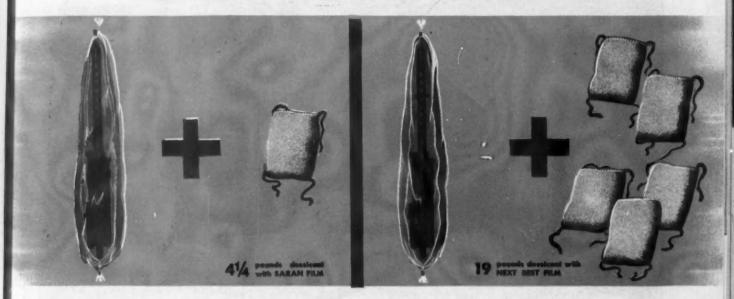
Template stora, and maintenance Shearing, metal storage, shipping

Louisville Plant 14 is an integrated parts fabrication plant, occupying what was formerly the new (Turn to page 82, please)



Just how moisture-proof is Saran Film?

Saran Film is three times more impervious to moisture than any other comparable material . . . Look at these facts



No transparent film completely controls all moisture. But different materials do vary in degree of efficiency. Knowledge of the extent of this difference is important to the packaging industry.

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Saran Film, for example, is outstanding in its ability to "keep moisture in its place"... and to do so over a longer period than other comparable materials. In the painstaking search for the best film to protect machine guns, every known type of transparent barrier was tested for its MVT rate. Results

proved Saran Film exceptional. As symbolized in the illustration above, it requires only 41/4 pounds of desiccant for 36 weeks' absolute protection.

This is but one standard of comparison for Saran Film. Others show it to be extra tough, flexible, clearly transparent, with good lasting qualities. Saran Film is thoroughly qualified to give adequate protection under the most difficult circumstances.

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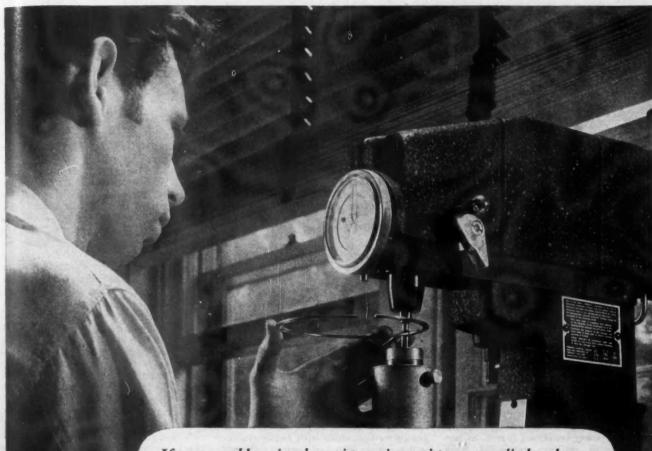
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Army's New Tanks

M-22 Airborne Tank (Locust) That Rolled Up Nazis M-18 Light Tank (Whippet) M-36 Tank Destroyer (Slugger) (For description of these newest combat vehicles being used by the U.S. Army in Europe, see page 44 in this issue)



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TRIES

With End of War in Sight, New Weapons Are Revealed

Automotive Industry Producing Five New Combat Vehicles Designed for Changing Battle Conditions

Even though the end of the war is in sight, new weapons continue to emerge from the country's arsenals and being used effectively against the enemy on the European battlelelds. Recently, Buick Div. of General Motors Corp. took the wraps off its M-18 tank de-stroyer, known as both the "Hellcat" and the "Whippet." (This tank and others described are illustrated on page 42 in this issue.) In production since July, 1943, the vehicle is characterized by a 55-mile-per-hour top speed, flashing maneuverability, and pulverizing fire power. It mounts a 76 mm high velocity cannon carried on a heavily armored, power traversed turret. It has an effective artillery range of more than seven miles. (Spectacular use of the new weapon has been reported by correspondents with the American Third Army in the fall of Orleans and General Patton's flanking swoop around Paris.) The M-18 weighs 19 tons, has a welded armor plate hull, a 360 degree revolving turret, and steel tracks equipped with center guides to prevent throwing off on sharp turns at high speed. A new type suspension is used to give unusual level riding qualities. Individual bogey wheel assemblies are equipped with shock absorbers and torsion bars, which function as springs to resist upward movement of the track wheel and support the weight of the vehicle. Slack in the track is taken up automatically by compensating linkage.

The vehicle is powered by a 485-hp radial aircraft engine, mounted at the rear on rails for ready removal for servicing or replacement. The torqumatic transmission and final drive also are rail mounted for easy accessibility. Assembly is at one of Buick's former automobile assembly plants at Flint, with about 80 per cent of the components used supplied by sub-contractors.

Companion vehicle to the M-18 is the "Greyhound" 19-ton light tank, which mounts a 75 mm gun and is classed officially as the M-24. In production at Cadillac Motor Car Div. of G.M. for several months, the tank carries fire power equal to that of a light tank, has speed above 40 miles per hour, low silhouette (overall height of 87 inches and hull height of less than five feet), sloped surfaces for protection, greatly

reduced ground pressure, greater maneuverability, and doubled obstacle climbing ability. It has the same type suspension used in the M-18. The power train consists of two Cadillac V-type, 8-cylinder engines basically identical with those used in passenger cars, and two Hydra-Matic transmissions operating through a power transfer unit. A new development is automatic gear operation in reverse, which enables the tank to climb to a crest of a ridge, fire a blast at the enemy and quickly back away to reappear at another point. The M-24 supersedes the Cadillac-built M-5, and incorporates improvements suggested by operators with battle experience together with best features gleaned from a study of captured enemy tanks and British and Russian combat

Still another G.M. division is represented in the parade of new combat

vehicles by the "Slugger," most power. ful tank destroyer ever to face the Germans. Designated the M-36 Gun Motor Carriage, this Fisher Body built vehicle mounts a 90 mm cannon, which can outreach and overpower the German 88 mm gun. Its 24-pound shell has a muzzle velocity of half a mile per second. It carries a .50 cal machine gun for protection against enemy aircraft. With its crew of five, it can cruise 150 miles. In production at the Fisher Body Flint and Grand Blanc, Mich., plants, the M-36 also is being built by Massey Harris. It is one of the 22 different tank and destroyer models produced by Fisher since early 1942. The division has turned out more than 13,000 tanks and tank destroyers so far in the war.

The Studebaker Corporation is producing a track-laying, water-going vehicle known as the "Water Weasel" and officially designated as the M-29c. This adaptation of the "Weasel" (M-29) is a full track vehicle, the tracks providing the water propulsion as well as the land traction, thus no complicated change-over is necessary when the vehicle passes from one element to the other. Its wide semi-flexible

(Turn to page 104, please)

Light Metals Plentiful, Steel Scarce. Scrap Prices Uncertain

Conditions in the Scrap Market Are Out of Line with the Firmness of Finished Steel Prices

By W. C. Hirsch

With the light metals-aluminum and magnesium-in ample supply and continuing paucity in the tonnage of many descriptions of steel available for nearby consumption, it is little wonder that much of the present-day thinking of metal consumers revolves around this condition. When the U.S. Corps of Engineers contracted the other day for 12,000,000 square feet of landing mats, in the production of which 45,000,000 pounds of aluminum will be used, it aroused, therefore, much interest. These mats, it is pointed out, are not intended to take the place of the heavy steel kind, but were especially designed to make possible their transportation by air transport or small cargo ships, their weight being approximately one-half that of steel mats. With the green light given by WPB to the light metals, in so far as

manpower shortage does not offset this letting down of the bars, competitive developments are being closely watched. To what extent further cutbacks in aluminum output, which have been approved by civilian and military authorities, will affect the market situation, remains to be seen, the objective of these moves having been announced as wanting to add to the labor supply. In connection with this subject it may be recorded that can manufacturers have recently been experimenting with the use of aluminum in place of steel, having been allotted 7,000,000 pounds for the third quarter for that purpose.

As has frequently occurred in the past, when the outlook was too beclouded for forecasts, conditions in the scrap market, which are out of line with the firmness of finished steel prices, are interpreted in some quarters as presaging the approach of an easier

(Turn to page 60, please)



To Select Heat Treating Data Quickly, Accurately

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annealing treatment, hardening treatment, furnace atmosphere and recommended drawing range. In addition you can determine for each Matched Tool Steel the hardness for various drawing temperatures.

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PRIES

Greater Output and More Workers Needed in War Industry, Says OWI

Heavy Duty Trucks and Tires Still Most Critical; Ship Repairs and Ship Building Not Up to Schedule

As the European war goes into what appears to be the last round, the Office of War Information reports a critical production lag in 13 categories of key war materials. The agency also states that approximately 400,000 more workers are needed to bring production up to the demands being made by the armed forces. Heavy duty trucks and tires still are in most urgent need, with tanks, heavy guns, heavy ammunition, signal equipment, ship building, and ship repairs also behind schedule.

Actually, these items are not behind original goals, but are not keeping pace with the increased demands for them occasioned by battle experience. Also, present schedules have been stepped up because of losses in the field. The Army has revealed that 3000 planes were lost since D-Day and that 150,000 tons of ammunition are used monthly. During the first 70 days of invasion, 900 tanks, 2400 automatic rifles, 1750 jeeps, and 1500 mortars were required for replacements. In testimony before the Senate War Investigating Committee, Maj. Gen. Lucius D. Clay, Director of the Army Service Forces, stated that July production of certain vitally needed items was as low as 53 per cent below June output and that August figures will not show appreciable improvement. He charged the lag to manpower shortages, fatigue, and optimistic war

The aircraft production picture continues to reflect the shifting emphasis from short range bombers and transports to long range heavy bombers. Following the announcement of cutbacks on the B-24 recently, the Ford Willow Run bomber plant went to a five-day week, nine hours a day, beginning Sept. 5. Although production is expected to be cut in half ultimately on B-24's, the August output was held to more than 100 a week. Some drop is expected in September because of the reduced work week, which has been on a six day, 18 hours a day basis. However, layoff of an estimated 9000 workers, previously expected because of reduced bomber schedules, has been by-passed through the designation of Willow Run by the Army as a special-purpose plant. As such, it will take over work from other companies now in aircraft production, allowing them to reconvert to civilian production. Latest reports indicate that removal of aircraft work from the Ford Highland Park and River Rouge plants to Willow Run has been deferred, at least for the present, upon protests of union officials.

Although WPB has indicated that the aircraft production program now is stabilized at about 8000 planes a month, manufacturers well know that the fall of Germany will bring immediate cutbacks. Evidence of this is seen in the announcement at an aviation manufacturers' forum in Washington recently that contract terminations on aircraft may be as high as 33 per cent following victory in Europe.

WPB announced that production of B-29 superfortresses topped production schedules in July by four bombers and that overall production was 8000 planes. August figures are expected to show a deficit of 400 to 500 planes under the quota of 8200, due primarily to changes made in plants to bring planes up to new standards set by military require-

Eastern Aircraft Div. of G.M. will increase production of TBM Avenger torpedo bombers for the Navy. At the same time, output of FM-2 Wildcat fighters will be cut back. Plants affected are at Linden, Trenton, and

Bloomfield, N. J., Tarrytown, N. Y., and Baltimore

Stinson Div. of Consolidated Vulter Aircraft Corp., Wayne, Mich., has turned out 2000 Stinson L-5's, known as the "Flying Jeep." Powered by a 185 hp Lycoming engine, the plane has a 24-foot wingspread and is used for reconnaissance by the artillery and in-

Indicating the need for certain types of ammunition, WPB at the urgent request of the Navy has assigned special directive treatment to the rocket program. The action places the rocket program on the same level with heavy artillery in matters of priority assistance, manpower referral, and other special treatment.

Postwar Jeeps

A contract to build the bodies for a postwar model of the Jeep has just been given the American Central Manufacturing Corporation, Connersville, Indiana, by Willys-Overland, Toledo. Under the terms of the agreement, production of the first 25,000 bodies will start just as soon as the War Production Board releases the necessary material allocations. While details are not vet available, it is understood that the design of this peace-time Jeep will incorporate several changes to facilitate its use for farm and general utility purposes.

Meanwhile, the American Central Manufacturing Corporation will continue to build the regular Jeep bodies for both Willys-Overland and the Ford Motor Company. To date American Central had produced approximately 350,000 Jeep bodies and is continuing to turn them out at the maximum daily capacity of the plant.

New Helicopter Under Development

With twin rotors whirling at the ends of streamlined pylons, the Platt-LePage helicopter XR-1 probably is the most eye-arresting aircraft now being tested by engineers of the AAF Materiel Command.

Ultimately, the XR-1 may reach production. It may yet see military service in a variety of uses, but, while successful in tests, the craft is still

experimental.

Only two helicopters, the R-5 and R-6-single rotor ships developed by the Materiel Command and the Vought-Sikorsky division of United Aircraft

Corp .- are in production.

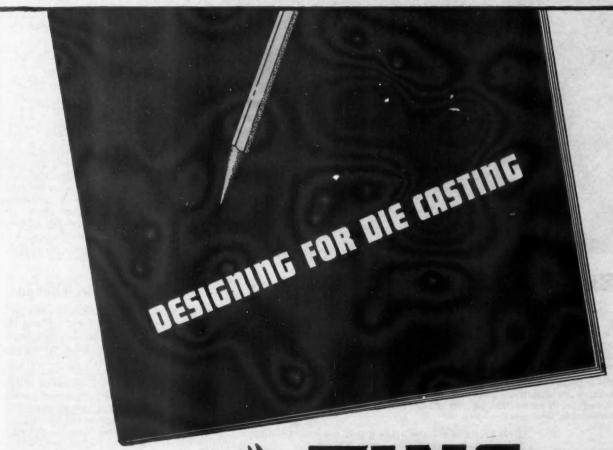
Military uses of aircraft capable of vertical flight, and zero (hovering) speeds, as well as forward motion, are obvious. They include personnel rescues from jungles or remote areas inaccessible to ground crews or to other aircraft, liaison and messenger service within combat zones and behind com-



Rocket Power Assists Take-Off

Rockets are being used successfully to get heavily - laden planes into the air, according to an announcement of the **AAF Materiel Com**mand at Wright Field, Ohio. Shown here is a B-25 medium bomber taking off with the assistance of rockets mounted beneath wings.

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bat lines, and observation and fire control work in forest areas.

Experimental history of the XR-1 dates to mid-1940, just 19 years after the U. S. Air Corps first ventured unsuccessfully into the helicopter field with a model designed and built by Prof. George De Bothezat.

Design of the XR-1 is basically the same as the successful German helicopter. It weighs about 4800 pounds. Its fuselage resembles a normal airplane fuselage minus engine or propeller. The tail is of conventional design. The engine—a 450-horsepower Pratt & Whitney, the most powerful ever installed in a helicopter—is lo-

cated approximately in the middle of the fuselage and is enclosed.

Two cockpits in tandem occupy the forward part of the craft and have sliding canopies like fighter planes. Compartment bottoms are of transparent plastic, allowing clear vision approaching the vertical and adding to the craft's usefulness in observation.

Extending from each side of the fuselage, just back of the cockpit, are two streamlined pylons, giving the impression of wings. Single rotors 30 feet, six inches in diameter rotate in opposite directions at the ends of the pylons, counteracting torque. Landing gear is conventional.



AWARDS

Names of winners of Army-Navy "E" awards in or allied with the automotive and aviation industries announced since the Sept. 1 issue of Automotive and Aviation Industries went to press:

THE INGALLS IRON WORKS COMPANY, Verona Plant, Verona, Pa.

RESISTOFLEX CORPORATION, Belleville, N. J.

SOLAR AIRCRAFT COMPANY, Des Moines, Iowa.

"E" Star Awards

for continued meritorious services on the production front have been awarded to the following firms:

EDWARD G. BUDD MANUFACTURING COMPANY, Philadelphia, Pa.

WESTERN GEAR WORKS, Seattle, Wash.

WESTINGHOUSE ELECTRIC & MANU-FACTURING COMPANY, Steam Division, Lester, Pa.

WESTINGHOUSE ELECTRIC & MANU-FACTURING COMPANY, Merchant Marine Division, Lester, Pa.

Bendix Will Enter Home Radio Field

The Bendix Radio division of Bendix Aviation Corporation will for the first time manufacture and market a line of home radio sets as soon as the military situation permits, it was announced by Ernest R. Breech, president. Home radios will be manufactured in the company's plants in Baltimore, it was stated.

Retractable Ailerons

Slow landings on blacked-out airfields are made possible for the Black Widow through the use of "retractable Ailerons," a secret feature of the P-61 just recently disclosed.

Northrop Aircraft, Inc., developed this device which is designed to replace the conventional aileron and permit the use of full span wing flaps for increased braking power. It is a long, scoop-shaped metal strip, dotted with holes, and is entirely concealed in a slot near the trailing edge on the outer wings of the plane, when not in use. These are mechanically attached to two small conventional type ailerons located at either wing tip of the plane.

In using the retractable ailerons to turn in the air, the pilot operates the controls in the usual manner. As he does so, the retractable ailerons rise from their slots and the scoops "spoil" the airflow, almost instantaneously eliminating the lift of the wing.



Extra Wear...Extra Safety... for Every Installation!

Grizzly Brake Linings are made of an exclusive asbestos-friction compound, moulded upon a strong wire-grid back under hundreds of tons of pressure. Rivet holes are countersunk to maximum depth, still fastening the wire grid firmly—preventing all danger of pulling off or working loose.

Thus Grizzly Brake Lining provides extra wear, with extra safety, because its exclusive compound retains the same co-efficient of friction throughout its entire life—life that is lengthened materially by the greater serviceable thickness.

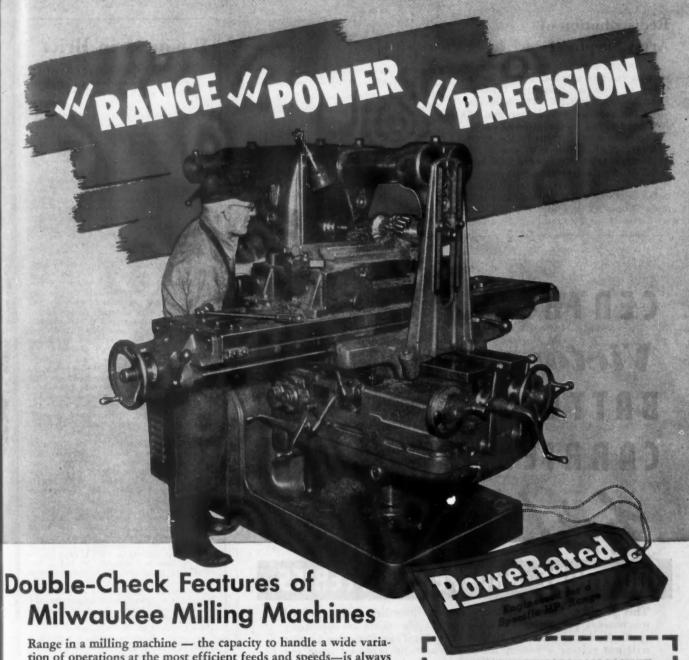
Only products of extra value are in order today—start using Grizzly Brake Lining—now!

EQUIPMENT MANUFACTURERS:

Write for your copy of "Building UP to a Name" an interesting photographic record of modern brake lining manufacture. Address Engineering Department, Paulding, Ohio.

GRIZZLY MANUFACTURING COMPANY

PLANTS AT PAULDING AND LOS ANGELES
Warehouse Stocks in Principal Cities



tion of operations at the most efficient feeds and speeds-is always an important factor.

But today - with advancements in cutting tools - motor hp. is the important feature to be checked when purchasing milling equipment. Be sure the milling machine you are considering is powerengineered to do the job - designed and built in relation to and with ample motor power for the work for which it is intended.

There is no need to resort to the unsound practice of substituting a higher hp. motor to gain power. The range of models of Milwaukee Milling Machines makes available a machine PoweRated and properly engineered for every class of job.

All Milwaukees are PoweRated - power-engineered in keeping with their rated motor hp. plus the normal overloads. They are precision-built and are capable of sustained precision-performance throughout a long productive life.

Remember — think of feed and speed range for light cuts — adequate motor power for heavy cuts - the need for sustained precision performance at all times. Check with a Kearney & Trecker field engineer in deciding which PoweRated Milwaukee is best suited to your specific needs.

Milwaukee Machine Tools

MEANS EVERY MILWAUKEE MACHINE IS POWER EN-GINEERED TO DO THE JOB

Milwaukee PoweRated Milling Machines

- Standard Models Horizontal, Vertical and Bed Types - available in Motor ranges from 3 to 25 HP.
- C.S.M. (Carbide Steel Milling) machines 20 to 50 HP.
- · Special Machines—Consult K&T engineers.



MILWAUKEE 14

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STRIES

Redistribution of **Army Surplus Tires**

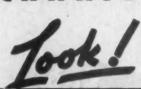
A unique plan of redistribution of surplus tires is now being used by the Office of Surplus Property, Treasury Procurement Division. The plan provides for national distribution and has just been tested in the disposal of 70,-000 tires declared surplus by the Army.

A group of 25,000 new and 31,000 used small truck tires were sold back to 23 of the 26 tire manufacturers in the U.S., each receiving an allotment based on their usual replacement business. These manufacturers will in turn pass them on to regular distributors, thus assuring a wide distribution. This plan will be followed by the Automotive Division of the Office of Surplus Property as other tires become available as surplus. All tires are being sold under existing regulations of the Office of Defense Transportation, the Office of Price Administration and the Rubber Director's Office.

Agriculture and Lend-Lease.

Another group of 14,000 tires were sold to other Government agencies. Among those participating in the purchasing of these were the Navy, Department of Interior, Department of

CENTRAL Victory BATTERY CARRIER





DROPPED

This popular, powerful battery carrier embodies a new, proved mechanical principle. Tension against the posts is constantly applied-even before the battery is lifted. Therefore, this carrier will not release a battery until it is actually removed from the posts by the mechanic himself.

NEW DESIGN PREVENTS SAGGING INTO ACID

The improved design keeps this heavy durable strap in a constant arc-it cannot sag into the acid and be destroyed like the ordinary carrier strap.

- Quickly Detached Easily Attached Inexpensive • 32 oz. 3 ply Rubberized Duck Strap Won't Stretch • Cadmium Plated, Heavy Gauge Steel throughout • Easy on the Hands . . .
 - Will Not Damage Battery Posts

2 SIZES

SHORT—For Regular Size Batteries LONG-For Long Type Batteries MAIL COUPON TODAY FOR PRICES AND DETAILS

900 SO. WABASH AVE. CHICAGO 5, ILLINOIS

	Central Equipment Co. Dept. BT 900 S. Wabash Ave., Chicage 5, III. Please send full details about your Central Victory Bat- tery Carrier.
	Name
	Firm
	Address
	City & State

Business in Brief

Written by the Guaranty Trust Co., New York, Exclusively for Auto-MOTIVE AND AVIATION INDUSTRIES

Fluctuations of general business acrivity have remained within a narrow range. The seasonally adjusted index of *The New York Times* for the week ended August 19 stands at 142.7, as compared with 144.3 for the preceding week and 141.6 a year ago.

Department store sales, as reported by the Federal Reserve Board, rose from 134 to 158 per cent of the 1935-39 average in the week ended August 26; and the indicated value was 18 per cent above the corresponding sum in 1943. For 1944 to date, the total is 7 per cent greater than the comparable amount last year.

Railway freight loadings during the week ended August 26 totaled 905,724 cars, 2.1 per cent more than the preceding weekly number and 0.2 per cent above the corresponding figure in 1943.

Production of electric power in the same period registered a considerable decline; and the total was 2.2 per cent above the output a year ago, as against a similar excess of 4.4 per cent re-ported a week earlier.

Crude oil production during the week crude oil production during the week ended August 26 averaged 4,667,450 barrels daily, 7,650 barrels below the all-time peak recorded in the week before but 11,150 barrels more than the average output in August recommended by the Petroleum Administration for War.

Estimated production of soft coal during the week ended August 19 was 11,875,000 net tons, 2.7 per cent less than the preceding weekly figure. For 1944 to date, the indicated output is 7.6 per cent above the comparable amount in 1943.

Engineering construction contracts awarded during the week ended August 31 totaled \$60,282,000, the third highest weekly figure reported in 1944, according to Engineering News-Record. This amount is 62 per cent above that shown a week earlier but 2 per cent less than the corresponding sum in 1943.

The Irving Fisher index of wholesale commodity prices, unchanged in the week ended August 25, stood at 113.0 per cent of the 1926 average, as against 110.5 a year ago.

Member bank reserves increased \$210,000,000 during the week ended August 30, but excess reserves remained at an estimated total of \$900,-000,000. Business loans of reporting members increased \$5,000,000 in the preceding week and stood \$267,000,000 above the total a year ago.

Lear Prepares For Reconversion

One of the last steps in the completion of Lear, Incorporated's, postwar plans was the recent change in name from Lear Avia, Inc. The change was effected preparatory to the company's entry into markets other than those of aviation equipment and aviation radio.

Proposed new marketing efforts will carry Lear, Incorporated, into industrial, commercial, and consumer fields. New "Products of Lear" will represent new development and will not reflect an effort to improve on merchandise value having pre-war recognition.



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SWEAT GLANDS are nature's temperature control. So accurate is nature's method that the body is held within a fraction of one degree variation, regardless of room or weather temperatures.

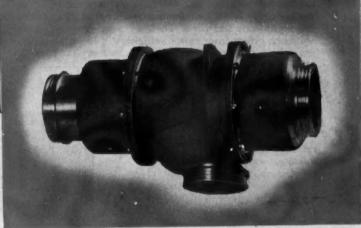
Aircraft engines need temperature control too. They must take off on short notice, in all kinds of weather, soar to the freezing cold of high altitudes and then dive thousands of feet with open throttles. No lubricating oil or engine cooling system could ever successfully cope with such conditions without the aid of sensitive temperature control instruments.

Sylphon Aircraft Controls provide engines with mechanical sweat glands: : : instruments responsive to the slightest temperature change. Simple, rugged and self-powered, they convert the temperature changes themselves into controlled mechanical movement, to adjust the flow of engine coolant so that constant engine temperatures are always maintained.

Write for Bulletin SB-822, which describes the latest developments in Sylphon Aircraft Controls,



Liquid-Cooled-Engine Thermostat, for controlling the amount of cooling medium circulated through the heat exchanger. Designed so that the valve position is entirely unaffected by static pressures in the cooling system, by varying pressure drops across the heat exchanger or control valves, or by changes in altitude.





SYLPHON

TEMPERATURE CONTROLS

BELLOWS MELLOWS ASSEMBLIES

THE FULTON SYLPHON CO., KNOXVILLE 4, TENNESSEE

Canadian Representatives, Durling Brothers, Mentreal



Throughout industry and the Armed Forces as well as in the home, housekeeping has become a real problem. With competent workers harder and harder to find, cleaning must be done by more efficient equipment.

In a wide variety of manufacturing plants and maintenance shops -both for industry and the military services - Kerrick Kleaners are saving up to 80% of the manhours normally required for cleaning equipment and parts. These efficient cleaners remove dirt and stubborn grease from motor vehicles, airplanes, machinery, floors everything from tiny precision parts to complete factories.

Heat, water, detergent and friction are scientifically combined in Kerrick Kleaners to remove dirt from all types of surfaces... faster, better and cheaper.

Kerrick Kleaners had years of successful experience in automotive and industrial cleaning to get ready for their present war assignments. They will again be available, in stationary and portable models, for most efficient steam cleaning.

Other Clayton products serving the Armed Forces include: Flash Type Steam Generators - Hydraulic Dynamometers – Hydraulic Liquid Control Valves – Boring Bar Holders and Boring Bars.



This illustration shows portable Model L-OEP



CALENDAR

Conventions and Meetings

Natl. Tool & Die Makers Assoc., Convention, Buffalo Sept. 28-30

SAE Natl. Aircraft Eng. & Produc-Oct. B-7 tion Mtg., Los Angeles

American Society of Tool Engineers, Syracuse, N. Y. Oct. 1 Oct. 12-14

American Welding Soc., Annual Meet-ing, Cleveland Oct. Oct. 16-19

American Society for Metals, Cleve-Oct. 16-20 land

Natl. Machine Tool Builders As Annual Meeting, Hot Springs, Oct. 19-20

. of Aeronautical Sciences, Natl. Air Transport Meeting, Washington

Distribution Conf., Chamber of Com-merce of the U. S., New York. Oct 23-24

Natl. Lubricating Grease Institute, Annual Meeting, Chicago Oct. 23-25

SAE Natl. Fuels & Lubricants Mtg., Tulsa Nov. 9-10

Natl. Standard Parts Assoc., Annual Fall Conference, Chicage Nov. 9-11

American Chemical Society Natl. Chemical Exp., Chicago Nov. 15-19

SAE Natl. Air Cargo Mtg., Chicago Dec. 4-6

Natl. Aviation Trades Assoc., St. Louis Dec. 6-7-8 SAE Annual Meeting, Detroit Jan. 8-12

Automotive Electric Assoc., Chicago Feb. 5-12

PUBLICATIONS

new brochure entitled Infra-Red At Work, describes the background and appli-cations of infra-red radiant heating for cations of intra-red radiant neating for various industrial tasks as developed by the C. M. Hall Lamp Co. It provides a short summary of uses of the method for drying finishes, in metal control, in wood working, for plastics, rubber and paper, etc.

Resistoflex Corp. has announced the publication of a new 16-page, two-color catalog on its Featherweight and heavy duty protransparent plastic called Compar. The catalog includes a section on cleaning, maintenance and repair of Resistoflex garments.

Production Data from The Houghton Line, for July, published by E. F. Houghton & Co., includes an article, Making 8"

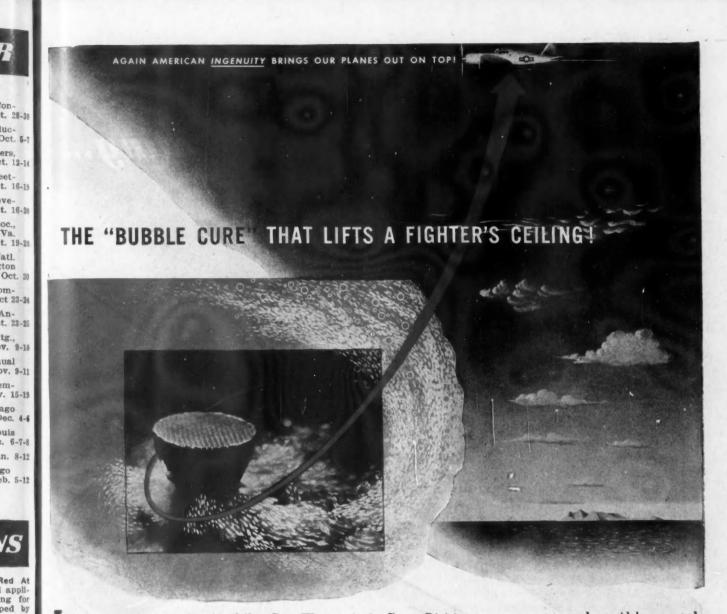
Line, for July, published by E. F. Houghton & Co., includes an article, Making 8" Artillery Shells, together with several other interesting and timely articles.*

A new 8-page illustrated booklet describing Adel Series K Fluid Metering Pumps has been issued by Adel Precision Products Corp. It shows exploded views, gives performance curves, schematics of typical installations and complete information on recommended aircraft and industrial tion on recommended aircraft and industrial uses.

A new manual, The Automotive Engine Valve, has been published by Aluminum Industries, Inc. It is written primarily for automotive mechanics and servicemen, and discusses the functioning and servicing of valves in non-technical and easily under-stood language. One section describes the causes of valve failures and their correction. The text is well illustrated with photographs and diagrams.*

The complete line of improved Model

860-A gear finishing machines, described in (Turn to page 56, please)



In the thin upper air gasoline "boils" in a plane's wing tanks. Vapor bubbles form. If they get into the gas lines they starve the motor-lower its ceiling.

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TRIES

But today that problem is solved. No matter how high enemy planes go, our boys can top them!

For American engineers have perfected an ingenious booster pump that keeps gas lines free of "bubble trouble". Hidden in the bottom of the gas tank, this tiny pump whirls out the bubbles as fast as they form . . . plays a giant's role in bringing our flyers back safely!

Borg-Warner, in its Pesco Division, produces huge numbers of these pumps for high altitude fighters and bombers. In addition, almost every type of plane is equipped with other Pesco pumps.

You'll find many such engineering achievements in Borg-Warner's list of more than 100 different items for war. And all spring from an ideal that is basic with Borg-Warner: "design it better-make it better".

That ideal means much to America. The essentials produced before the war by Borg-Warner's many units are

so numerous and so widely accepted in industry, on the farm and in the home, that there is hardly an American who does not benefit from them every day.

Partners with the automotive and aviation industries in peac and war, Borg-Warner supplies these and other essential parts...

CLUTCHES AND CLUTCH PARTS . GEARS UNIVERSAL JOINTS AND DRIVE SHAFTS TRANSMISSIONS . TIMING CHAINS

CARBURETORS - RABIATORS PUMPS . AVIATION STEEL



BORG-WARNER

P eace time makers of essential operating parts for the automotive, aviation, marine and farm implement industries, and of Norge home appliances . . . these units which form the Borg-Warner Corporation are today devoted exclusively to the meeds of war: borg & beck • borg-warner international • borg-warner service parts • calumet steel • detroit gear aircraft parts • DETROIT VAPOR STOVE • INCERSOLL STEEL & DISC • LONG • MARBON • MARVEL-SCHEBLER CARBURETER • B-W SUPERCHARGERS, INC. • MECHANICS UNIVERSAL JOINT • MORSE CHAIN • NORGE • NORGE MACHINE PRODUCTS • PESCO PRODUCTS • ROCKFORD CLUTCH • SPRING DIVISION • WARNER AUTOMOTIVE PARTS . WARNER GEAR

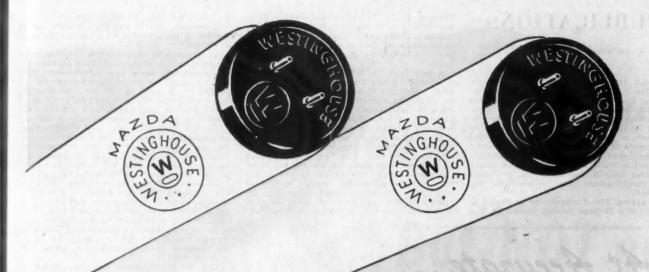
SMOOTHNESS in the coating...

means SEE-ABILITY

in the lamp



WESTINGHOUSE PRESENTS JOHN CHARLES THOMAS • SUNDAY 2:30 EWT., N.B.C.
TED MALONE • MONDAY, WEDNESDAY, FRIDAY 10:15 EWT., BLUE NETWORK



Fluorescent powders are tricky things to handle. Especially when it comes to applying them evenly inside a glass tube!

Uneven distribution causes minute valleys and peaks. In valleys the coating is too thin to fluoresce, while the peaks form shadows.

Hence the necessity for perfect smoothness of application, and the uniform thickness of coating from end to end of the tube.

Achieving this result is the aim of every step in the exacting Westinghouse procedure. From processing of raw materials to the final mixing of the phosphor powder, Westinghouse methods are concentrated on making and keeping the fluorescent powder uniformly smooth.

Carefully controlled schedules of grinding, acid washing, firing and ball milling insure uniformity. This extra care and attention counts . . . keeps Westinghouse fluorescent lamps bright from end to end.

And that's why, when you order fluorescent lamps, it pays to ask for Westinghouse. Your Westinghouse dealer can supply you right now for essential war lighting . . . and also to a limited extent for essential civilian use. Westinghouse Electric & Manufacturing Co., Bloomfield, New Jersey.

HELP SHORTEN THE WAR . . . BUY MORE BONDS THAN BEFORE!



IES

PUBLICATIONS

(Continued from page 52)

technical bulletin No. 860-A-44, is now available from Michigan Tool Co. A discussion of the principles of crossed-axis gear cutting is included in the bulletin. Curve-shaving, a process for slightly reducing tooth thickness toward the ends of the teeth to prevent concentration of loads on the ends of gear teeth, is also discussed.*

on the ends of gear teeth, is also discussed.*

An improved Detroit tap reconditioner is described in Bulletin No. DTR-3 now available from Detroit Tap and Tool Co. Complete specifications are included in the bulletin.*

Evaluating The Forgeability of Steels is the title of a 78-page booklet issued by The Timken Roller Bearing Company's Steel and Tube Div. It contains, for the first time, recommended forging temperatures of sixty-eight steels, as determined by the hot twist test conducted in the company's laboratories.*

A new bulletin, Oil Power Fluid Motors, is offered by the Pump Div. of the Sundstrand Machine Tool Co. It illustrates and describes the operating principles, features, possible applications and engineering data of Sundstrand Fluid Motors.*

of Sundstrand Fluid Motors.*

The White Motor Co, is offering a new maintenance manual on tires, which takes into consideration the vehicle conditions affecting tire life. The first section takes up Wheel Alignment as related to front axles and details the nature of and treatment for toe-in, camber, caster, etc. Section Two describes wheel alignment as related to the rear axle. Section Three is devoted to the vehicle frame; Section Four

to wheel balance, Section Five, to brakes and Section Six, to the fifth wheel. Each section is illustrated with photographs and drawings.*

An illustrated bulletin, No. VDS-44, describing its line of standard Pull-up broaching machines, tools and attachments has been brought out by Colonial Broach Co. A section is devoted to the basic tooling of these machines with several pages of specification tables augmented with drawings of machines, tools and attachments included.

A manual on the design and construction of pneumatic tires has been published for United States Army training schools by The B. F. Goodrich Co. It is known as Section 3 and consists of 50 well illustrated pages, discussing the basic principles of pneumatic tire design, including pictured descriptions of the role which each part of the tire plays in its operation and how tires are manufactured. Measurements and other data on each of the important classifications of heavy duty military and civilian tires and proposed load and inflation table for them are included, together with tube, valve, flap and rim data.*

The B. F. Goodrich Co. has issued a general booklet on its industrial rubber products, produced especially for designers of industrial equipment as well as consumer products. In includes discussions of the company's line of vibro-insulators, devices of rubber and metal which reduce vibration, molded, extruded, lathe cut and sponge rubber products, etc.*

Bulletin No. P-1202, with 12 pages of in-

Bulletin No. P-1202, with 12 pages of information on the application, operation and design of Bristol Radiation Pyrometers has been published by The Bristol Co. Another Bulletin, No. A115, describes a new line of air-operated controllers, Model 93 series, has also been issued by The Bristol Co.*.

Obtainable by subscribers within the United States through Editorial Dept. AUTOMOTIVE and AVIATION INDISTRIBE. In making requests for any of these publications, be sure to give date of the issue in which the announcement appeared, your name and address, company connection and title.



DID you ever see a fourslide in operation—turning straight wire into intricately-shaped wireforms with each combination stroke of its four slides? If you have, then you know the skill and experience that is necessary to set-up these machines—to put them in operation for high production of unusual round and flat wire shapes.

The fourslide department of Accurate has turned out millions of wireforms, in hundreds of different shapes, for munitions, implements of war and peace-type products. Accurate engineering and mechanical ingenuity has solved many unusual and difficult wireform problems—the results of which were greater production, time and labor saved and minimum cost.

If you use wireforms, or will in you future plans, discuss them with Accurate—to your advantage.

Send for your copy of the New Accurate Handbook on Springs. It is full of data, formulae and tables you'll find useful. Free, of course.



SPRINGS WIREFORMS STAMPINGS

ACCURATE SPRING MANUFACTURING CO.
3811 W. LAKE STREET CHICAGO 24, ILLINOIS

PERSONALS

George M. Lange has joined the Fuel Injection Division of the Ex-Cell-O Corp. He was formerly with Timken Roller Bearing Co.

Roger C. Fleming, for more than a year regional director for the General Motors Dept. of Public Relations in Indianapolis, has been made director of advertising and public relations for the Allison Div. of General Motors.

Ford Motor Co. has announced the appointment of Alan B. Pease, for many years a sales executive, to the new post of assistant director of sales.

c. D. Wing has been appointed director of advertising and sales promotion of the Nash Motors Div. of Nash-Kelvinator Corp. His headquarters will be at Detroit.

It has been announced that Frank F. Russell, general manager of the National Aircraft War Production Council in Washington, will direct the organization on a consulting basis.

Henry A. Kinley, affiliated with the Westinghouse Lamp Div. of Westinghouse Electric & Mfg. Co. for 34 years, has been appointed manager of the district office at Detroit.

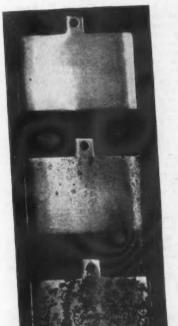
Dee H. Hollowell has been elected a vicepresident of Continental Motors Corp. and placed in charge of sales and service for the Aircraft Div.

Wilkening Mfg. Co. has announced the appointment of Thomas W. Moss as Detroit representative. Mr. Moss succeeds Warren K. Lee, who is now factory manager at Wilkening headquarters in Philadelphia.

The appointment of J. A. Bascle, Jr., as district manager for the Louisiana, Mississippi and southern Alabama area, has been announced by Mack-International Motor Truck Corp.

Clay H. Hollister, Jr., has been appointed

the Water's Fine! Sure But-NOT on Metal



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Plate 1 was coated with NOX-RUST.
Plate 2 with another product. Plate
3, unprotected. This is how the
camera saw them after 24 hours'
There's a NOX-RUST formula
tailor-made for your exact requirements.

Metal Needs the Protection of

NOX-RUST

The Master Rust Preventive

NEW NOX-RUST No. 369 QUICK-DRY

15 Minutes to Dry and Easy Removal!

(Meets U. S. Army AXS 673, Rev. 1, Amend. 2; also proposed AXS 1349)

Yes, it's here. A new, quick drying rust preventive. Drying time sliced in half! But that's not all! NOX-RUST No. 369 **OUICK-DRY** is easy to remove, too.

NOX-RUST No. 369 QUICK-DRY dries to a glossy black. A tenacious, permanent coating. Yet removal is quick and easy when desired.

Many other advantages: NOX-RUST No. 369 QUICK-DRY won't chip or crack. Workmen like it because it's non-toxic and of pleasant odor.

NOX-RUST No. 369 QUICK-DRY has a controlled viscosity and absolute uniformity. You'll like New NOX-RUST No. 369 QUICK-DRY for the absolute protection it affords plus its quick drying qualities. We'll be glad to send you technical details.

Write today for the popular NOX-RUST use chart. director of pubic relations of Adel Precision Products Corp.

Mills N. Ripley, formerly Eastern Dis-trict Sales Manager for Bijur Lubricating Corp., has been appointed sales manager

of the new regional and branch office sales headquarters of The Hydraulic Press Mfg. Co., New York City.
C. R. Terry, former State Director of OPM and Executive Asst. to the Director of WPB's regional office in Cleveland, has been appointed sales manager of the new regional and branch office sales headquar-ters of The Hydraulic Press Mfg. Co., Cleveland.

Fred L. Curtis has been made manager of the sales engineering dept. of Norton Co., with headquarters at Worcester,

The appointment of T. W. Tinkham as general manager of the Eclipse Machine Div. of Bendix Aviation Corp., Elmira,

Y., has been announced. He succeeds William L. McGrath, who is retiring after 28 years of service with this division.

Charles S. Mattoon, director of industrial elations for the Airplane Div. of Curtiss-Wright Corp., Buffalo, has resigned.
Appointment of E. A. Bonneville of New

York as a regional manager for The Crosley Corp. has been announced.

United Aircraft Corp. has elected Leonard S. Hobbs vice-president for engineering and has also appointed him a member of the Operating & Policy Committee of

Alfred Marchev, president of the Repub-lic Aviation Corp., is the new president of the Aircraft War Production Council, East

Harvill Corp. has elected Harry R. Gillett to the position of executive vice-president; Francis Petit was elected secretary and A. J. Hanlon, formerly with International Nickel Co., Inc., was appointed pro-

duction manager.

The appointment of David J. Bonawit as chief engineer of the Marshall-Eclipse Div of Bendix Aviation Corp. has been announced.

Capt. E. D. Almy, asst. general manager of Joshua Hendy Iron Works, will serve as manager for the organization's Crocker-

Wheeler Div. at Ampere, N. J. He will be succeeded by Harry C. Gunetti.

Thomas Bartlett has joined the staff of the Lawrence Aeronautical Corp. as oper-

ations manager.

John B. Moore has been made general manager of the Gaybex Corp., Nutley, N. J. He was formerly with the Babbitt Industrial Specialties Co. as development engineer

H. C. Kenyon has been made general sales manager of Inland Rubber Corp., a subsidiary of the Minnesota Mining and Mfg. Co.

Walter H. Dyer has been made sales manager of Zenith Auto Radio Div. of Zenith Radio Corp. He was formerly with RCA.

The board of Directors of the American Engineering Co. has elected Thurlow E. McBride to the office of vice-president and treasurer of the company.

Omer L. Woodson, vice-president of Bell

Aircraft Corp. and manager of the Georgia Div., has resigned.

D. W. Sanford, western division sales manager for the past two years at Los Angeles, has been made resident vice-president of the Goodyear Tire and Rubber Co. of California. He succeeds J. E. Mayl, who has returned to Akron as head of the company's tire sales division,
L. E. Mefford, vice-president's assistant in
charge of the Washington, D. C., offices,
will succeed Sanford. George M. Reveire
will take over Mefford's former post.

L. F. Weyand, general sales manager of the Minnesota Mining and Manufacturing Co. adhesive and coating divison, has been promoted to general manager.

Earl M. Taber, acting service manager for Pontiac Motor Div. of General Motors Corp. since Feb. 1, 1943, has been promoted to service manager.

Edward G. Hardig, formerly sales man-ger, has been made vice-president in ager. charge of sales and a director of National Tool Co.

John J. Dunn, who has been working on Chrysler's tank building program, has been appointed truck distribution manager for

the Dodge Division.

George H. Hufford has been promoted to vice-president of Weatherhead Co. He formerly was chief engineer of Thompson Products' Detroit division and executive engineer of the Houdaille-Hershey Corp. Buffalo division.

DeSoto Div. of Chrysler Corp. has appointed six new district managers. They are Al Tuma, Detroit; A. E. Walbridge and C. L. Davis, New York; Vance Fish, Kansas City; E. J. Brodell, Cincinnati, and Homer Burger, St. Louis.

Blakeslee is the name! for

and

Metal Parts Washers

Degreasing Machines

That name "Blakeslee" in the aviation and automotive fields today, as for years past, stands for highest efficiency in parts washing and degreasing equipment. Blakeslee engineered - for you units mean top speed in removing oil, chips and drawing compound from all metal parts to hasten machining, finishing, inspection, etc.

Blakeslee engineers, with years of specialization in solving metal cleaning problems welcome the opportunity to serve you, now and after victory.

TORONTO

• Wire or write details for quotations for war contract requirements. Descriptive catalog on request.

Main Office and Plant: Cicero Station, Chicago 50, Illinois



John Steel, writer, engineer, and specialist in the field of electronics and mechanics, has been appointed account executive on the staff of Florez, Phillips and Clark, Detroit marketing agency.

Cook Electric Expands

MetalFusion Corporation of America has become a subsidiary of Cook Electric Company, according to an announcement made by Walter C. Hasselhorn, Cook president.





NEW YORK

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are using McQuay-Norris precision parts. Our 3 years' experience in precision manufacture, our long and intensive work in metallurgy, heat treating, clinical research and laboratory experiment, enable us to turn out the sturdy, dependable parts demanded by modern aviation. Your inquiries are invited.

PARTS FOR AIRCRAFT ENGINES

Piston Rings Oil Sealing Rings Supercharger Rings Carburetor Parts Machined Aluminum Pistons Piston Pins Counterweight Cheek Pins Machined Magnesium Parts Cylinder Hold Down Nuts Hardened and Ground Parts

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Machined Magnesium Parts Piston Rings

EQUIPMENT FOR MAINTENANCE OF AIRCRAFT

Pistons for Oxygen Compressor Piston Rings for Oxygen Compressor Pins for Oxygen Compressor Pistons for Air Compressor Pins for Air Compressor Piston Rings for Air Compressor

LANDING GEAR PARTS

Machined Aluminum **Pistons** Piston Rings Hardened and Ground Parts

PRECISION WORKERS IN IRON, STEEL, ALUMINUM, BRONZE, MAGNESIUM



September 15, 1944

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ON THIS A-F ENGINEERED

CONVEYOR SYSTEM * * *

STANDING on a small dolly temporarily attached to this A-F Engineered Conveyor System, the operator moves along with this truck (destined for service with the U. S. Naval Forces) while the cab is being fastened into place.

Located on the floor above is an A-F Conveyor System, so arranged that

cabs for trucks of a dissimilar nature meet the truck unit for which each was designed at just the right moment for efficient handling.

The small photograph shows the same operation for trucks destined for domestic use. In postwar use, too, this A-F Engineered Conveyor System will help make and break production schedules and lower operating costs. May we help your plant do the same? Write today.



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New Branches, Offices And Representatives

The Hydraulic Press Manufacturing Company, Mount Gilead, Ohio, has established a Branch Sales Office at 401 No. Broad St., Philadelphia, Pa. A. R. Rose has been appointed manager of the new branch office, which will serve Philadelphia, Baltimore, and surrounding territory.

A direct Chicago sales office was opened Sept. 1 by The Weatherhead Company, Cleveland, Ohio. The new office, located in the Pure Oil Building, Wacker Drive and Wabash Avenue, will be headed by Charles T. Craig, formerly director of purchases for the company, working with Robert A. Lennox and C. V. Landwerlen, Weatherhead sales engineers.

Aluminum Industries, Inc., Cincinnati, Ohio, manufacturer of Permite Products, has opened a new sales office at 9 Rockefeller Plaza, New York City. This office will accommodate the New York district managers and representatives of the Automotive Replacement, Industrial and Paint Divisions of the company.

The Square D Company announces the opening of a new manufacturing plant and warehouse located at 2310 Ranier Avenue, Seattle, Washington. Walter H. Bodle has been appointed manager and will direct its operations.

The New York Factory Branch of General Controls, Glendale, Calif., has occupied new and larger quarters in the Architects Building, 101 Park Ave., New York City, according to Branch Manager John Hammond.

The George Gorton Machine Company of Racine, Wisconsin, announces the appointment of Russell, Holbrook & Henderson, Inc., 292 Madison Avenue, New York, as exclusive representatives in the New England territory.

Light Metals Plentiful, Steel Scarce

(Continued from page 44)

tone in the steel market generally. Some steel mills have not been taking in as much scrap as dealers expected them to. In some transactions levels below ceiling prices were reported. The marketing of much alloy scrap entails considerable difficulty, and in the background looms uncertainty over what in the way of scrap may come from European battlefields, possibly upsetting all calculations of the supply in sight. Conservative steel men hesitate to accord to any market forecasts at this time more than passing attention. Not until reconversion gets actually under way will it be possible to form even a tentative estimate of the postwar market, they say.

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"A War Measure of First-Class Magnitude"

mic pronunciamento. were handed them. Remember? triumph to any front.

HEN the standing of India was occupying the attention of Washington, Mohandas Karamchand Gandhi wrote to the India League of America:

"I want you to look upon the immediate recognition of India's independence as a war measure of first-class magnitude."

For a man so definitely non-Hollywood in dress or words "FIRST-CLASS MAGNITUDE" amounts to a cataclys-

Again it shows that one who is fired by a great idea automatically adds emphasis to enthusiasm! And that is an important business measure.

You saw it well illustrated when war conversion was hurled at manufacturers . . . and when "impossible" schedules

Men were far from enthusiastic.

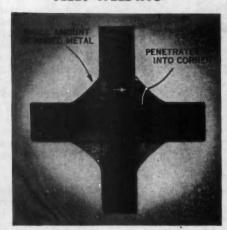
But viewed in the light of subsequent experience, those quotas for air, land and sea weapons today seem modest. All because aroused men quickly found out first-hand what Arc Welding could do. And when it did the job well, they became enthusiastic . . . which brings

A War Measure of First-Class Magnitude"... he says

CONVENTIONAL WELDING



"FLEET-WELDING"



TYPICAL FILLET WELDS

STRENGTH: SPEED:

Stronger than plate

5" per min.

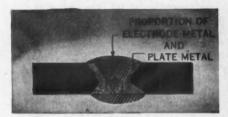
COST:

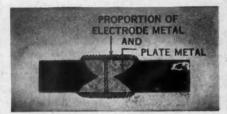
STRENGTH:

Stronger than plate

SPEED: COST:

12" per min.





TYPICAL BUTT WELDS

STRENGTH: SPEED:

Stronger than plate

COST:

2" per min. 100%

STRENGTH: SPEED:

Stronger than plate 9" per min.

COST:

25%

LOOK, MAHATMA: While you pondered on the magnitude of political measures for winning, Lincoln Engineers were enthusiastically working out a very practical measure that is away out in front in magnitude:

"FLEET-WELDING"

A First-Class Production Measure . . . of First-Class Magnitude

This new, revolutionary technique using "ARC-FORCE" to speed the welding of all types of joints in plate, shapes and sheet is bringing back reports of 25% to 75% faster welding . . . also savings in electrode material and power. Cases also are reported where back-chipping and plate beveling are eliminated.

The savings shown at left are typical of this new technique developed by Lincoln engineers.



A Lincoln engineer is available nearby to help you apply "Fleet-Welding" Technique. Write for Bulletin No. 440 which gives complete explanation of the simple technique and the welding procedures.

THE LINCOLN ELECTRIC COMPANY CLEVELAND, OHIO

America's greatest natural recourse ARC WELDING



GENERAL CONTROLS' branch and agency sales and service offices are located in principal cities (see list below)—their facilities and counsel as near as your telephone. A wire, letter or telephone call (see yellow classified section of telephone directories) will bring a qualified Controls engineer to your office.

ATLANTA 3-General Controls Co., 319 Spring St. N.W.

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BUTTE-Sullivan Valve & Eng. Co., 910 S. Arizona Sc.

CHICAGO 11-Automatic Controls Co., 450 E. Ohio St.

CINCINNATI 2-R. R. Gannon Co., 223 Gwynne Bldg.

CLEVELAND 15—General Controls Co., 3224 Euclid Ave.

DALLAS 2-General Controls Co., 1100 Cadiz St.

DENVER 10-General Controls Co., 2011 S. Gilpin Sc.

DETROIT 2-General Controls Co., 6432 Cass Ave.

EL PASO-George W. Herlin, 401 Santa Fe

GREAT FALLS-Northwest Supply

HUNTINGTON-H. Y. Keeler, 208 Hines Bldg.

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PHOENIX-Crane Company, 233 S. First Sc.

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SEATTLE 1-Refrig. & Power Specialties Co., 2309 5th Ave.

TUCSON-Crane Company, 35 Toole Ave.

Write for Catalog 52



Canard Aircraft

(Continued from page 19)

separation at the elevator may lead to alternating oscillations about the transverse axis; this defect can be compensated by the provision of slots, etc., in the elevator surfaces. Lateral stability is fully assured by rudder surfaces of ordinary proportions, provided they are arranged at sufficient distance behind the CG of the machine. The stability and maneuverability of canard aircraft are favorably and further affected by the fact that the control surfaces are always outside the propeller slipstream; this is of particular importance in view of the continually increasing area loading and engine power of modern aircraft. The use of a tricycle undercarriage with a landing wheel under the fuselage is imperative in canard design.

The power unit cannot be mounted in so many different positions as in the standard type. Where there is only one engine it must be located in the tail of the fuselage. The higher efficiency of the pusher airscrew, however, is counterbalanced by the end plates (fins) required on the wings; these need to be relatively large on account of the short over-arm involved; in relation to the distance from the CG of the aircraft, this increases the air drag. An alternative is to use twin rudder booms. The best method of ensuring sufficient lateral stability (the principal difficulty in the design of canard aircraft) is to use twin power units.

The statics of the airframe exhibit certain features indicating favorable development of the flying weight. Lower net weight implies higher useful load, or longer range; alternatively, the lifting area of the wings can be reduced, resulting in a still lower drag. The static design is further facilitated by the CG being located in the fuselage in front of the wings, i.e. at a point available for useful loads; variable loads, such as fuel and bombs, are particularly well accommodated in this section of the fuselage. Further, the fuselage has no dead space; the nose accommodates the retractable nose wheel, instruments and armament; the central section the pilot, fuel and useful load and the tail section the wing unit connections.

In military aircraft the fuselage nose of the canard type provides room for a powerful and concentrated armament with the field of fire unimpeded. Moreover, the relatively high speed, good take-off and landing properties even on difficult terrain (by reason of the nose wheel) and good field of view make this type aircraft particularly suitable for fighter duties. A canard type bomber (with two or four engines in the wings and double rudders developed as end plates on the wings) would be distinguished by a free field of fire in all directions and particularly good combat power in consequence.

For civilian air transport the low drag and greater economy of operation should prove attractive, while the nonspinning quality, good field of view and easy landing make the canard a good prototype for the "fool-proof airplane." Although some further tests are still necessary to clarify the question of its flying qualities, it is clear that there are no unavoidable impediments to the construction of the canard type aircraft.

With regard to the accompanying suggested design for a canard type single-seat fighter (Fig. 1) the full performance calculation for this project showed that, compared with a modern fighter of orthodox type with equal wing area and engine power, and with allowance for factors tending to affect speed, the top speed would be increased by about 37 mph or 10 per cent. The following are some of the data used:

Power unit DB. 601 engine Flying weight 4840 lb Wing area 151 sq ft Elevator sur-

Total lift area 175.8 sq ft Length 25 ft Span 27.5 ft

face area 24.8 sq ft Wing loading 27.6 psf
In the design for an experimental canard-type aircraft
(Fig. 2) special care has been taken to make it resemble
the conventional type as closely as possible (apart from
the control surfaces) to enable easier accurate calculation
of the flying properties. The fuselage nose in front of the
CG is kept very low to prevent an instability moment.

IF IT IS HYDRAULIC OUR MACHINERY IS BUILT IN ACCORDANCE WITH THE SPECIFIC REQUIREMENTS OF EACH CUSTOMER

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NEW YORK

Designing the Hydraulic System

(Continued from page 23)

where timing depends upon the restriction of flow in the operating circuit. (c) Variable pressure type; where timing depends upon external forces acting upon the actuating mechanism. Formulae have been evolved for each of these types of calcuations, and with the use of the pressure drop calculator for the optimum tube size for any desired tubing can be obtained.

Landing Gear Circuit

Hydraulic actuation for landing gears has achieved its present popularity because of the essential simplicity of obtaining linear motion by means of a hydraulic cylinder, and because where a comparatively large amount of work is involved, the hydraulic cylinder offers by far the best weight-horsepower ratio of any system. The landing gear circuit is simple, con-

sisting merely of selector valve and cylinders. This simplicity was achieved through the omission of sequenced door operations, run-around valves, and hydraulic locks, either external or built into the cylinder. The doors are me chanically actuated off the strut and the locks are operated by the selector valve handle. The tail wheel is spring loaded for extension, in order to eliminate the need for emergency connection. The landing gear motion is limited by stops which are external to the cylinder, therefore, sufficient overtravel must be allowed to prevent the cylinder from bottoming before the gear has locked in either extreme position.

The cylinder area is fixed by the load curve and the design factor. Retraction of the gear is accomplished by extension of the cylinder in order to apply the larger cylinder area to the greater load requirement. The lines and selector valve sizes are determined by a timing calculation of the constant flow type.

Wheel Brake Circuit

Hydraulic actuation is almost universally used for brakes on aircraft. There are many reasons why hydraulic power is so widely used for brakes in preference to proposed electric systems. In addition to simplicity, light weight and sensitivity, no expenditure of power is required to hold the brakes in a parked position.

The brake system includes a brake accumulator isolated from the rest of the system by a check valve so that loss of main system pressure will not deplete the power upon which the brakes are dependent. Pressure is applied to the brakes by means of power valves, one for each brake. The brake valves reduce the system pressure to a pressure within the brake operating range. The brake pressure resists the foot pressure so that the pilot has the feel of the brakes. Thus, if the brake power source is depleted, the pilot will get no reaction from the pedals and will know, even before landing, that the brakes are inoperative. He will then have time to switch to the emergency brake system. The brakes are parked by a ratchet which holds the brake valve plunger in the depressed position. Once set, the brake pressure will not vary.

The air charge in an accumulator is not dissipated in the event of failure in the hydraulic system. It is a ready source for emergency power, and was, therefore, selected for emergency brake operation on this airplane. The main circuit accumulator was chosen, rather than the brake accumulator, since otherwise a rupture in the brake accumulator would incapacitate both main and emergency brake circuits. emergency air brake valves are similar in design and operation to the hydraulic valves. They are actuated by the brake pedals but are ineffective except when the shutoff valve leading from the ac-



88,000 pounds per sq. in. tensile strength in extruded shapes, 75,000 pounds in alclad sheet—stronger than any aluminum alloy in use today-nearly two times the yield strength of ordinary structural steel and one and one-third times the tensile strength. That's Alcoa's new high strength alloy, 75S.

No untried youngster, this alloy. Alcoa's research and development divisions have spent years in testing the performance of experimental quantities. In the fall of 1943, the first commercial run was put through Alcoa mills, and production has continued at an ever-increasing pace. Already, at least eight major aircraft companies are building new experimental planes in which 75S is the principal structural material.

75S is now a standard alloy for alclad sheet and extruded shapes. Plain sheet, plate, rolled rod and bar made from 75S continue on an experimental basis, but may be obtained for certain projects.

With WPB approval, you can employ 75S in your products. Our representatives will gladly help you work it into your designs. ALUMINUM COMPANY OF AMERICA, 2110 Gulf Building, Pittsburgh 19, Pa.



ALCOA ALUMINUM

September 15, 1944

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For variable speed applications such as Diesel-powered vehicles and motor ships, the automatic timing feature in the Ex-Cell-O type KB fuel injection pump provides for maximum power output and minimum fuel consumption by advancing fuel injection timing according to engine speed. Speed-responsive timing materially results in smooth, flexible operation throughout the operating range and increases the service life of vital engine parts. For applications not requiring automatic timing, the Ex-Cell-O type KD pump provides the same high degree of dependability and efficiency. Both of these war-proved pumps reflect Ex-Cell-O's quarter century of precision production and years of experience in the Diesel field.

The Ex-Cell-O nozzle is a worthy complement to Ex-Cell-O pumps, specifically designed for efficiency, dependability and trouble-free service.

For complete information, engine builders should address Diesel Division, Ex-Cell-O Corporation, Detroit 6, Michigan.



cumulator is opened. As long as the shutoff valve is closed, the emergency brake valves offer no resistance to the motion of the brake pedals.

Wing Flap Circuit

Both right hand and left hand flaps are actuated by a common cylinder. This eliminates the need for flow dividers, or other flap aligning devices. The wing flap cylinder loads are roughly proportional to the flap angle and to the air load on the flaps. The cylinder size is such that the maximum force available is less than the design strength of the flaps. Thus, if the flap valve is opened at high speeds, the flaps will extend part way and stop when the air load balances the cylinder load at system pressure. As the airplane speed is reduced, the flaps will continue to extend. Conversely, if the air load increases due to increased speed, change in angle of attack, or as a result of a gust, the cylinder pumps oil back into the system and the flaps retract sufficiently to relieve the excess loads. Flap operation must be comparatively slow, in order not to change the airplane trim too rapidly during the critical periods of takeoff and

The first trial timing calculations indicated that the smallest available tubing and valve sizes resulted in too rapid timing and that two restrictors, one in the up line and one in the down line, had to be added to the circuit.

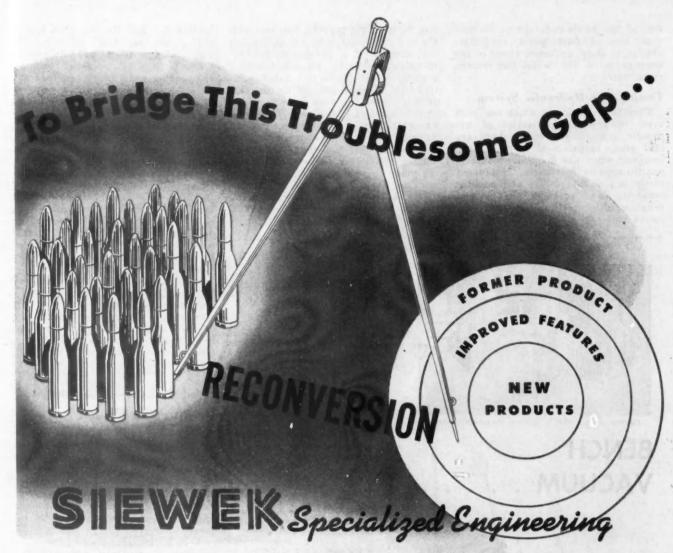
In the event of a rupture in the wing flap circuit, the back pressure in the return line, during the operation of the landing gear or the bomb doors, can open the wing flap selector valve return poppet and the fluid can be lost through the rupture. In order to prevent this, a check valve is added to the wing flap return line.

If the landing gear were dropped while the wing flaps were extended, the temporary reduction in the system pressure would permit a reduction of the flap angle. To prevent this, a check valve is added to the wing flap pressure line. However, in order toprovide for thermal expansion in the "flap up" line, a very small bleeder hole is drilled through the poppet of this valve. Tests under actual conditions indicated that the presence of the bleeder hole does not reduce the effectiveness of the check valve in this instance.

Bomb Door Circuit

The bomb door circuit is comparatively simple. Two cylinders, one at each end of the bomb doors, open and close it by means of an overcenter linkage, which relieves the cylinders of external forces in the extreme open or closed position. This arrangement allows the omission of a check valve in the pressure line, since the cylinders will have no tendency to change position, even if the pressure changes in the system due to operation of any of the other circuits.

A check valve is added to the return.



Looming ever closer is the problem of reconversion, and many manufacturers, watching it draw nearer, are too busy to work on it now - when they should!

To these manufacturers, Siewek Engineering Division offers its services to develop, or realize a post-war plan. This nationally known organization of experienced engineers and skilled tool designers is qualified to give you exactly the service you require: developing ideas and products—designing, building and laying out machines and tools.

Contact Siewek today. Competent men backed by a fully rounded organization will break down your reconversion problem and cooperate with your own engineering staff on its solution. Siewek will help you to bridge your gap beween war and peace! Ask our representative to call.

SIEWEK TOOL DIVISION OF DOMESTIC INDUSTRIES, INC.

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SIEWEK RAPID CLAMPING DRILL JIGS

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line of the bomb door circuit to prevent loss of fluid under conditions similar to those discussed above in the description of the wing flap return check valve.

Testing The Hydraulic System

Despite the progress which has been made toward standardization of hydraulic systems and units, there are still many surprises in store for the designer when the finished product is put through its first paces. To prevent costly last minute delays and possible accident, it is advisable that a test program, as complete as time and manpower will allow, be carried out during the preflight period. The test program for this airplane called for the construction of a functional mockup. including the actual units and tubing arranged in their correct space relationship, modified only by the interior dimensions of the cold room in which most of the test took place. The pump was driven by a variable speed motor through a drive shaft running through the wall of the cold room, thus permitting the motor to be outside, and the pump to be inside the room. The reservoir was constructed of transparent Lumarith to permit visual inspection of flow phenomena. The pilot's seat and pedal arrangement

mocked up, and the test pilot had his say about the "feel" of the brakes months before the actual airplane was ready for him. A weighted mockup of the landing gear mechanism was built to study clearances, deflections, friction, timing, etc. Conditions simulating high altitude, low temperature, high temperature, adverse loading and emergency situations were imposed on the hydraulic mockup. In addition to the invaluable information obtained by the engineers, the mockup afforded the mechanics the opportunity of becoming familiar with the installation, operation and servicing of the hydraulic system. Not the least of the advantages derived during the period of testing was the improved mutual appreciation by the engineers and the mechanics of each other's problems.

In addition to the mockup tests, each hydraulic unit was thoroughly tested in accordance with the established procedures and the specific requirements of the installation. These tests paid rich dividends in the reduction of troubles encountered with the proto-

type.



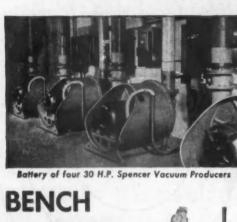
Studebaker Corp. has announced that it plans to double its prewar automobile production facilities in the postwar period. New buildings will be constructed and employment of from 14,000 to 16,000 persons is contemplated, compared with a payroll of 8000 workers when automobile production was sus-

H. S. Vance, chairman of the board, and Paul G. Hoffman, president, both predicted that it would take six months after "go day" to get into production, but conceded that the period might be shortened if no major bottlenecks in tooling and components develop. The company already has surveyed its suppliers and reports that the situation is generally favorable, although a few trouble spots are expected. Alternate suppliers will be found if original subcontractors are unable to supply needed

Studebaker has placed orders for needed machine tools and has been promised delivery in four to five months, Hoffman stated. The principal immediate trouble, he said, is in getting draftsmen and engineers. The company is prepared to carry on simultaneous manufacture of automobiles and war products if necessary, Vance said. There is no intention to stay in the air-

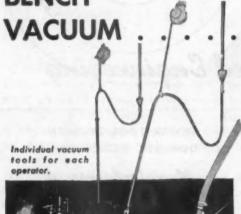
craft field, however.

Hoffman stated that Studebaker does not accept as incontrovertible the belief that postwar cars must be priced from 25 to 30 per cent above prewar levels. Every dollar increase, he said, is a handicap, and the company is fightting to hold it to a minimum. Cooperation of labor in obtaining increased efficiency of production will be a major factor in keeping prices down, he added.





separators collect the dust.



at Sperry

Now vacuum is piped overhead to assembly and inspection benches at Sperry Gyroscope.

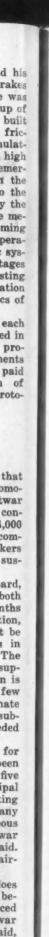
Vacuum tools of various sizes and types, with handy shut off valves remove dust and metal particles instantaneously without blowing dirt onto operators or the work.

All debris is deposited overhead in a giant separator, situated next to batteries of four thirty horsepower vacuum producers. The same equipment is used to clean floors, walls and overhead

Ask for information on Spencer Vacuum Bench Cleaning.

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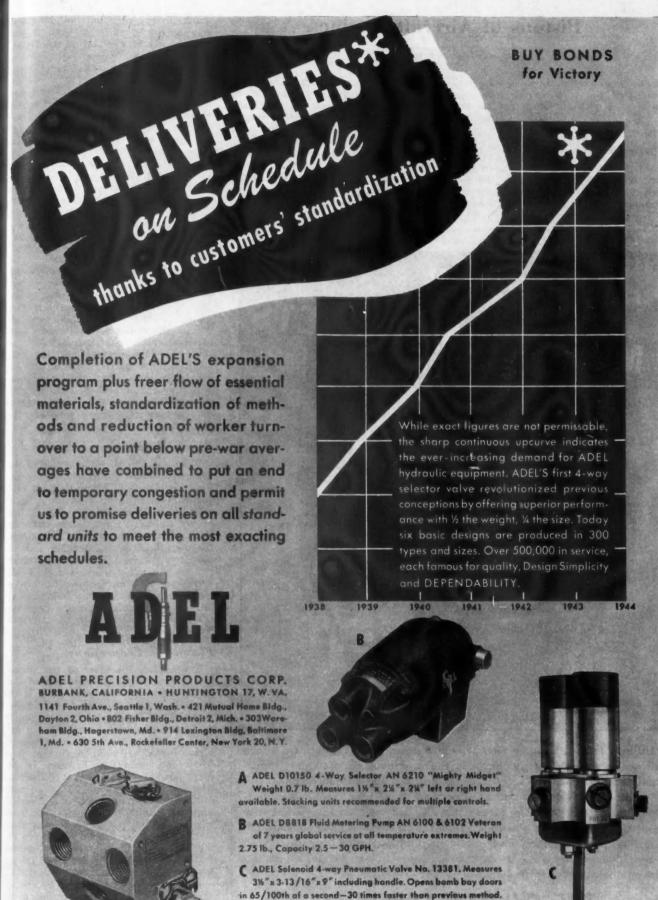


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After VICTORY ... the ADEL-AGE

Pistons of Aircraft Engines

(Continued from page 34)

piston pin, owing to the difficulty of determining the true bearing pressures in service, with due allowance for the accompanying deformation of the pin and bosses.

Piston Weights

Fig. 7 shows that variations in type are immediately reflected in the net piston weights, while these and the equipped piston weights vary directly

as the piston diameter. The lower values are principally represented by the pistons of older engines with lower power loading (France) and isolated designs in which lightness has been specially sought at the cost of much elaborate machining. At the upper limit, on the other hand, are some special designs in which economy in manufacturing has received paramount consideration—chiefly the long-skirted

trunk pistons of American design. It may appear remarkable that, despite the considerable amount of machining, the Bristol sleeve valve engine pistons are still in the medium-weight class, but this must be attributed to the greater length of piston above the piston pin level, compared with the poppet valve types. It is seen that, on the average, only about three-quarters of the total equipped weight is represented by the naked piston, while in less favorable designs, such as the Russian AM 38, the weight of the accessory components is up to one-third of the total weight, indicating overdimensioning of the piston pin and more or heavier piston rings.

Net piston weights per unit power output are pictured in Fig. 8, which shows that this factor varies within narrow limits and increases fairly constantly with the piston diameter. This development indicates progressive deterioration of the piston power loading factor in the larger diameters, although the contrary might have been expected; the explanation may be sought in the decrease of the unit stroke volume performance of the engine with increasing cylinder volume.

Net weight of pistons, total weights of equipped pistons and partial weights of accessory components are listed in Table 3.

Piston Materials

Table 4 shows the composition of the different alloys used in the pistons. That deviations in proportions of constituents beyond the customary tolerance limits are not merely accidental, is proved by the Wright Cylone, Russian M105 and the Hispano-Suiza 12Y, where the material has a lower Mg content than the standard Y alloy. In British pistons the RR59 alloy is rigidly adhered to. Russian pistons contain a higher percentage of iron. In American alloys of the Al-Si type, the composition agrees exactly with the German EC124 alloy.

Piston Pin Proportions

The outside diameter of the piston pin is from 20 to 25 per cent of the piston diameter, the lower limit being found in pistons working under lighter loads, while the higher values apply to over-dimensioned, heavily loaded designs, particularly where closely spaced piston bosses are used. A further factor in this connection, however, is the corresponding wall thickness of the pin, which is usually about 5.0 to 7.0 mm in the principal cross-section, but varies sensibly with the power loading and size of piston. Variations from this standard are the 4.3 mm thick pin of the Allison engine and the pin of the Russian AM38, which has a wall thickness of as much as 9.2 mm. The development of the wall thickness along the axis of the pin is usually tapering, with the exception of the cylindrical bore of the pin in the Wright Cyclone engine, and somethimes has cylindrical lands at the ends. In mushroom-locked float-



Millions of Chicago Screw Company Mushroom Valve Tappets are in use all over the world, in gasoline and diesel engines, in stationary industrial engines, truck, passenger car, tractor, bus and aircraft engines.

"Chicago" Mushroom Valve Tappets are made from steel and carburized, or cast iron with cam faces chilled. Quality and accuracy are rigidly controlled throughout every step from rough stock to finished material. Lightweight design, accuracy of machining operations, coupled with years of experience, has made "Chicago" Mushroom Valve Tappets the 1st choice of motor engineers.



THE CHICAGO SCREW CO. 1026 So. Homan Avenue · Chicago 24, III.





Gear tooth hardness need no longer be a compromise between machinability and wear resistance. Red Ring Rotary Gear Shaving as the final machining operation on the green gear, during which approximately .001" of stock is removed from the tooth surfaces, corrects cutting errors of index, helical angle, tooth profile, eccentricity and undesirable tooth roughness.

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This corrected gear may then be induction hardened to whatever surface hardness is desired and without objectionable distortion. Hardening without detrimental distortion is frequently accomplished on gears carburized after shaving by quenching in dies and sometimes by liquid carburizing and quenching without dies. No grinding of tooth profile is necessary.

On a 5.145" P.D. gear so treated, final involute error is held to between +.00015" and -.00015"; parallelism to .0002"; tooth spacing to .0001" to .0002"; and accumulated error to .0008".

WRITE FOR DESCRIPTIVE FOLDER ON RED RING GEAR SHAVING



Specialists on Spur and Helical Involute GEAR PRACTICE

Originators of ROTARY SHAVING AND ELLIPTOID TOOTH FORMS

NATIONAL BROACH AND MACHINE CO.

MEN AING PRODUCTS

3600 ST. JEAN . BETROIT 13, MICH.

Is Your Problem One of REDUCING OVERHEAD?

• A survey of your material handling operations may reveal methods for substantially reducing your plant overhead. The new Baker Catalog contains actual case histories of many companies who have accomplished this with Baker Trucks. A few of them are listed below.

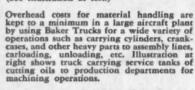


Faced with the need for doubling his storage space a large publisher avoided adding warehouse rent to his overhead by installing a Baker Hy-Lift Truck. Tiering skid loads of paper stock multiplied the effectiveness of available floor space and on rental savings alone he paid for his truck in 18 months. (See illustration at left.)

The world's largest manufacturer of domestic ranges cut handling costs 75% and speeded plant production with a fleet of 8 Baker Trucks. On one operation, that of carrying steel sheets from shearing department to press room, costs were cut from 14ϕ to 1.6ϕ per ton. (See illustration at right.)

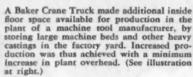


A leading producer of wall board for prefabricated homes found Baker Low-Lift Trucks ideal for handling large quantities of 8 x 14 ft. panels. Besides effecting substantial savings in handling costs, this company reduced overhead by conserving manpower and minimizing damage to material transported. (See illustration at left.)





On the recommendations of a Baker Material Handling Engineer a warehouse installed a handling system using a Baker Fork Truck. Handling costs were reduced from 67¢ to 50¢ per ton—a saving of 25.4%. Overhead was thus reduced \$153.00 per week or \$7956.00 per year. (See illustration at left.)









WRITE FOR YOUR COPY

Plant and production managers, traffic managers, superintendents, purchasing agents and any others concerned with material handling will find the new Baker Catalog No. 52 a valuable reference.

BAKER INDUSTRIAL TRUCK DIVISION

of The Baker-Raulang Company

2154 WEST 25th STREET • CLEVELAND, OHIO In Canada: Railway and Power Engineering Corporation, Ltd.



ing pins in pistons of the full-skirted type, such as the Twin Wasp and the Russian AM38, the pin length is about 92 per cent of the piston diameter, while in pistons with external lightening pockets the pin length varies from 70 to 80 per cent of the piston diameter. The pin of the Cyclone is particularly short, owing to the manner of securing, and entails a high bearing pressure. The weight saving in pins of varying design can be assessed by the ratio of the weight of the pin, G_B, to the equatorial moment of resistance, W, of the principal cross-section. This ratio attains a most favorable value of 110 g per cc in the Allison engine, while the high value of 178 g per cc is typical of the pin of the Russian AM38 engine. It is interesting to note that the values for British designs are all at the lower limit of the mean range. Proportions and characteristics of pins are shown in Table 5 and Fig. 9.

Pin Material and Finish

Pin material is in most cases a casehardening chrome-nickel steel having a core strenght between 100 and 130 kg per sq. mm. Considerable similarity between British and American practics in respect to composition exists. Additions of about 4.25 per cent Ni and 1.3 per cent Cr predominate, Mo being present only in small quantities up to 0.1 to 0.15 per cent. Allison pins depart from this in having no Cr. The other pins examined, particularly the Russian types, show lower Ni and Cr of about 3 per cent and 0.8 per cent respectively, with an otherwise identical make-up. The depth of case, averaging 0.6 mm, was almost identical in all the pins examined; the surface hardness was correspondingly as much as $R_{\rm c} =$ 55 kg per sq mm. Since considerations of weight are paramount, no attempt is made to simplify or economize in the manufacture. This is obvious from the prevalence of taper in the bearing zones and the almost universal grinding of the internal bore, together with careful rounding of fillets and edges.

Printer for Gummed Tape



This Topflight tape printer, marketed by Topflight Tool Co., Towson, Md., utilizes ordinary gummed paper tape. It is equipped with four fonts of different size curved type. The printer will handle any width tape from ¼ in. to 1½ in.



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I PREDICT ...

by Morris Sanders

Industrial Designer of New York

The kitchen of tomorrow will have no taint of the drudgery that characterized it in the past. A symbol of its efficiency will be the new refrigerators you will buy with your War Bonds. I have designs in my files for a horizontal, counter-height refrigerator that enables the housewife to see its entire contents without wearisome stooping. It has multiple compartments with varying degrees of temperature from "deep freeze" to "cool", and a special "private" compartment for ice cubes. There will be no wholesale release of cold air every time the refrigerator door opens, consequently it will be more economical. Furthermore, its cubic area will allow for more actual storage space than in the past

NOTE: The Weatherhead Company, one of the oldest and most important manufacturers



Weatherhead

Manufacturers of vital parts for the automotive, aviation, refrigeration and other key industries.

Plants: Cleveland, Columbia City, Ind., Los Angeles Canada—St. Thomas, Ontario



New Production Equipment

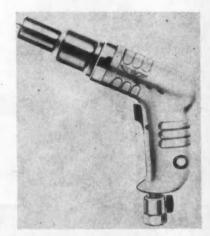
A NEW line of impact screw drivers and nut setters with positive torque control is offered by The Aro Equipment Corp., Bryan, Ohio.

A torque regulator, located in the handle, allows the operator to easily regulate the torque necessary to tighten the screw or nut. There is ample adjustment to meet most screw driving and nut setting conditions.

Pneumatically powered, this tool operates with a roller clutch impact mechanism having only four major parts—anvil, hammer and two cylindrical steel rollers. When in operation, the centrifugal force throws the two

steel rollers out against the hammer; this transfers the full torque through to the work in the form of a sudden impact. When the selected torque is obtained, the rollers rebound from the anvil face and do not allow the hammer to engage for impact.

The Model 1011 impact screw driver



Model 1011 impact screw driver

will accommodate Phillips, Reed and Prince or standard chisel point bits and finders for slotted screws.

The Model 1012 impact nut setter is available with 9/32 in, or % in, square drive adapter for sockets.

THE P. A. Sturtevant Co., Addison, Ill., has developed a new torque wrench which permits accurate torque readings by sound and feel as well as by sight. It is named the Sensory model and closely resembles the standard Sturtevant torque wrench in appearance but incorporates two new features. The standard wrench depended on visual reading to determine the applied torque—the Sturtevant Sensory model or wholies "sound" and "feel"

embodies "sound" and "feel."

These Sensory features work as follows: A trigger finger is provided which can be set at any desired signal-



Sturtevant Sensory model torque wrench

ling point. As torque is applied with the wrench, and at the instant the "set" torque is reached, the sensory action sounds a loud and distinct click and imparts a definite strong impulse to the hand. Thus, through three senses, sight, sound and feeling, the operator automatically releases his pull on the wrench, making torque both fast and accurate.

(Turn to page 78, please)



• If you cut any of the annealed or unannealed steels, non-ferrous alloys, plastics, glass or ceramics—solid bar, tubular or flat stock—a Campbell Abrasive Cutting Machine will help you. • Tell the Campbell

Engineering Department materials, shapes, sizes, lengths before cutting, lengths of cut off pieces and hourly production required. They'll give you data without obligation.

Campbell 1

ABRASIVE CUTTING MACHINES

ANDREW C. CAMPBELL DIVISION · Bridgeport, Connecticut

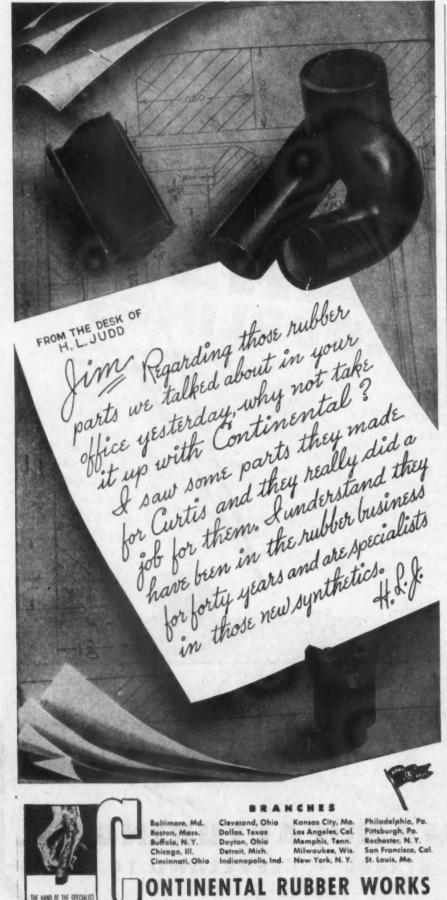
AMERICAN CHAIN & CABLE COMPANY, Inc.



In shipyards as well as aviation and fliddly and the same couplings factor in boosting production, and loy ering costs. Hansen couplings save time and effort, they're the sasiest and simplest coupling on the market to connect and disconnect. No thisting, turning the same coupling on the market to connect and disconnect. No thisting, turning to the same coupling on the market to connect and disconnected and locked. Save many steps and many minutes for the operator because tool can be save many steps and many minutes for the operator because tool can be save many steps and many minutes for the operator because tool can be save many steps and many minutes for the operator in sures from 2 outomatically turned on when on when a disconnected at the operator's bench or wherever is inserted and automatically turned of when plug is disconnected at they will handle present a they will handle present a sures from 2 ounces to over 10,000 pounds without leakage. Careless operator cannot waste air. There are Hanse outplings for air, oil, grease, and solve the save of the



HANSEN MANUFACTURING CO. 1786 EAST 27th STREET . CLEVELAND 14, OHIO



New Production Equipment

(Continued from page 76)

H AND-OPERATED turret-equipped bench lathes are quickly converted into automatics by the Newton Automat, now in production, according to the makers, the Newton Manufacturing Co., Los Angeles, Cal.

The Newton Automat actuates cross slide, bed turret and chuck; eliminates all manual operations excepting orig-



Newton Automat

inal setups and cutting tool replacements. It is equipped with a set of standard cams which will handle almost any job. An automatic cut out, adjustable to work of different character, is said to eliminate tool spoilage and parts rejection.

STANDARD Gage Company, Inc., Poughkeepsie, N. Y., is now in production on TeBo gages. The gaging head of the TeBo gage is a section of a sphere with a protective plating of hard chromium. On the periphery of the spherical head is a smaller projection which is also a part of a true sphere.



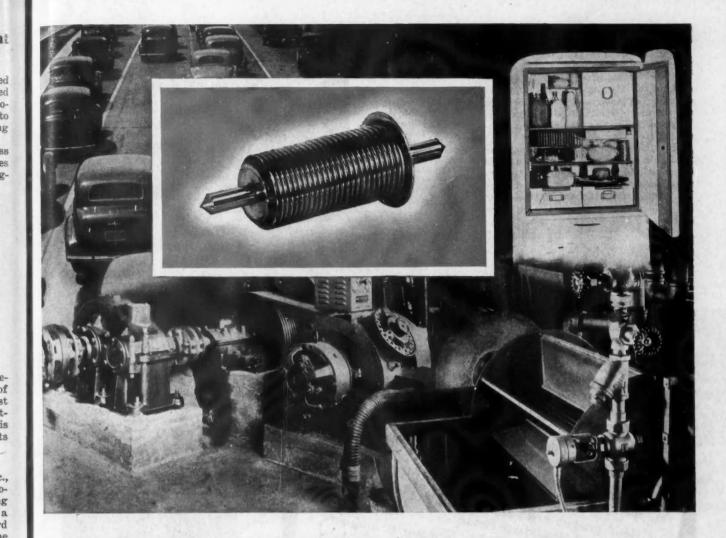
TeBo gage

This projection may be adjusted to the limit of maximum tolerance or to compensate for wear. Adjustment within reasonable limits is made by means of two tapered screws acting against the inset in a "V."

LATEST addition to the line of the Hydraulic Press Manufacturing Company, Mount Gilead, Ohio, is a new 16-oz capacity plastic injection molding machine for injection molding of thermo-plastic materials.

The straight-line hydraulic mold clamp consists of a double-acting ram, fitted with metallic piston rings, working in a smooth bored steel cylinder. Main ram is equipped with a small internal booster ram, which provides a fast closing speed.

The injection unit, is also operated by



A KEY TO IMPROVED CONTROL

HUNDREDS of different control instruments... from simple refrigerator and automotive thermostats to the incredibly accurate devices on aircraft, marine and other equipment... depend on Bridgeport Bellows for accurate and unfailing performance.

There are many excellent reasons why Bridgeport Bellows have found such a wide acceptance. Their dependability is one of these. All Bridgeport Bellows are made from single pieces of metal, and sizes up to 8" in diameter are formed without any seams or joints. In addition, all Bridgeport products are inspected step by step throughout manufacture to make sure that each bellows and bellows assembly is completely up to specifications.

Bridgeport Bellows are available in many different sizes and shapes . . . each one designed to meet a certain set of conditions. Bridgeport has also produced hundreds of finished bellows assemblies for many well-known manufacturers.

Complete engineering, experimentation, testing and manufacturing facilities at Bridgeport are geared to meet even today's production demands. Write for the new catalog RB-100.



Bellows Assemblies . . . Bellows . . . Bellows Devices

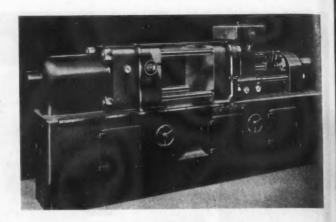
BRIDGEPORT THERMOSTAT

COMPANY, INCORPORATED-BRIDGEPORT I, CONN.

direct hydraulic means. The injection chamber is securely mounted to a steel cradle. Chamber is designed with new interrupted wedge locking device permitting removal of chamber by simply curning it sixty degrees. The injection chamber employs a two-zone heating system, using electric band heaters with Wheelco indicating temperature controls.

Machine can be operated manually or semi-automatically. Four adjustable knockout rods are provided for operating knockout bars in mold. A sliding type safety gate prevents closing of the mold clamp while gate is in open position.

H-P-M all-hydraulic injection molding machine



Developing a OTOR-DRIV These advantages offered by Black & Decker fractional horsepower motors are well worth considering: 1. Low product weight and compactness resulting from 2. Good product performance because of a thoroughly 3. Streamlined appearance because motor is integrated Our thirty years' experience is avail. able to your engineering department. into the product design. THE BLACK & DECKER ELECTRIC CO. THOROUGH ENGINEERING is the basic factor behind the successful operation of this aircraft heater motor and many other special application motors we have designed for all types of equipment.

Black& Decker

SPECIAL APPLICATION MOTORS
FRACTIONAL HORSEPOWER

A GENERAL-PURPOSE two-station hardening and quench table used in connection with high-frequency induction heating generators is being offered by Induction Heating Corporation, New York, N. Y. Arranged with quick change coil connections so that jobs can be set up in 2 to 3 minutes to change a heating coil, it is only necessary to make two coupling connections to the leads located at each outlet station.

It can be used either as a single purpose unit, using two identical fixtures,



Hardening and quench table made by Induction Heating Corp.

or it will serve as a general-purpose table for various kinds of hardening operations, even where the lots may run as low as 6 or 12 pieces.

Hose connections are provided at the front of the panel, which in turn connect to quench rings that surround the part being heated, thus permitting a spray quench to be applied. The duration of the quench is controlled by the master timer that operates a solenoid valve.

A HEAVY-DUTY formed wheel grinding machine, Type GG-24-48, has been announced by The Gear Grinding Machine Company, Detroit. This new grinder handles either coarse or fine pitch gears with diameters up to 24 in. It takes 48 in. between centers.

The index control is such that indexing can function at both ends of the stroke or on the tail stock end only and the index cycle stop is selective from 0

(Turn to page 114, please)



ANY MANUFACTURERS are faced with the urgent wartime necessity of reclaiming and re-using metal containers. The demand is for a cleaner that will do a thorough job -do it fast-and keep costs down.

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A prominent oil refiner found the answer in a Pennsalt Cleaner.

The problem was to remove various types of oil, grease and solvents from steel drums—and to strip paint from these containers. The operation was carried on continuously in a 1000gallon drum washer at 145 to 155 degrees Fahrenheit.

cleaning compound, followed later by an additional 300 pounds.

The Pennsalt representative was able to improve greatly on this with the correct type of Pennsalt Cleaner. The amount required was only about 35% of the previous cleaner. The cleaning action was highly effective - the drums dried faster-and grease was saving this plant 331/3 percent!

That's a saving that should interest you, if your plant has a metal cleaning problem. Let our experienced technical staff show you how a Pennsalt Cleaner will help you get better results at lower costs. Or write fully to our Special Chemicals Division, Dept. AA.

MANUFACTURING COMPANY 1000 WIDENER BUILDING, PHILADELPHIA 7, PA.

NEW YORK . CHICAGO . ST. LOUIS . PITTSBURGH . CINCINNATI . MINNEAPOLIS . WYANDOTTE . TACOMA

Reynolds Aluminum Fabrication

(Continued from page 40)

Mengel unit for the manufacture of plywood airframe sections.

Let us consider, first, a quick high-spotting of activities in Plant 12. The operation begins with the storage of aluminum sheet of various sizes and specifications delivered according to schedule directly from the Reynolds sheet mill a short distance away. The sheet is uncrated, inspected, and delivered to the adjacent shearing department by an overhead monorail hoist system. The shearing department is fully equipped with modern shears such as Niagara and Cincinnati, in a wide range of sizes, from 20 feet down.

Another of the large departments is devoted entirely to routing and drilling. Here will be found various makes and types of routers-hand and automatic types-which are employed in the shaping and contouring of sheet metal parts to templates. From the routers, aluminum parts go to the burring benches-another large group-where all rough edges are smoothed by power burring equipment, or by hand.

One of the more recent departments is a press section, equipped with a battery of two 500-ton Clearing presses. and one 250-ton Clearing press. Occupied principally with R-301 aircraft forming is the drop hammer department, equipped with a large battery of the familiar Chambersburg Cecostamp hammers, and several rope-type hammers. A number of small furnaces take care of the melting of metal for Kirksite dies.

Certain of the heavy parts produced in this plant require heat treatment. Among other equipment for this purpose, they have a large aging furnace made by Drying Systems. Parts requiring some re-forming to template and forms to take out possible distortion resulting from heat treating are routed for machine restrikes, or, when necessary, to the hand forming benches.

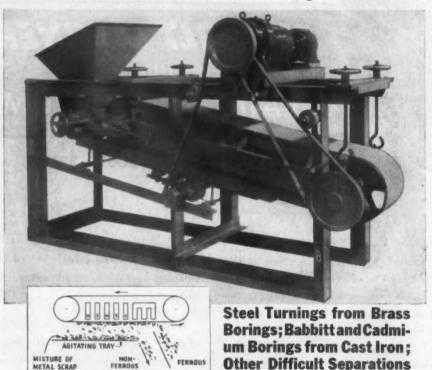
The press department is an enormous operation embracing heavy hydraulic presses and a large number of all manner of small mechanical presses. Typical of the large hydraulic equipment are a 5000-ton Lake Erie, a 2500ton Birdsboro, and a 750-ton doubleaction Bliss hydraulic, equipped with air chamber. The Lake Erie Press is said to be one of the largest of its kind in the aircraft industry. Except the Bliss, each is arranged for fourtable operation to utilize the enormous capacity of these giant presses. For each press will be found a large group of women operators who assemble the forming dies with suitable blanks, filling each of the tables. The tables are movable on rails, the movement being controlled by a scheduling operator. These presses utilize a modification of the Guerin dies process, using rubber pads. Another interesting item is a large Hamilton mechanical press of 1300-ton capacity formerly making automobile parts in a Detroit area plant.

A large heat treating department serves the press shop, handling the various cycles of heat treatment specified for individual alloys. Major part of these facilities consists of Lindberg furnaces provided with quenching tanks at the exit end of each unit.

Quality control is an essential feature of the entire operation. In keeping with good practice, parts in production are given a preliminary inspection while in process. However, all parts must pass through the final inspection department where they are checked for conformity to templates and forms and for surface quality. Parts may also be Navy inspected in the Reynolds plants at customers' re-

We are now ready for a quick look at Plant 14, a completely integrated fabrication unit. Functionally it is designed for the production of heavy and small stampings; principally for various types of baffle plates for air-

the machine that separates Welled scrap



With ordinary separators, it is difficult, if not impossible to secure satisfactory separation of badly entangled ferrous and non-ferrous scrap. The Dings Type BN agitating separator was specially de-

signed for this purpose.

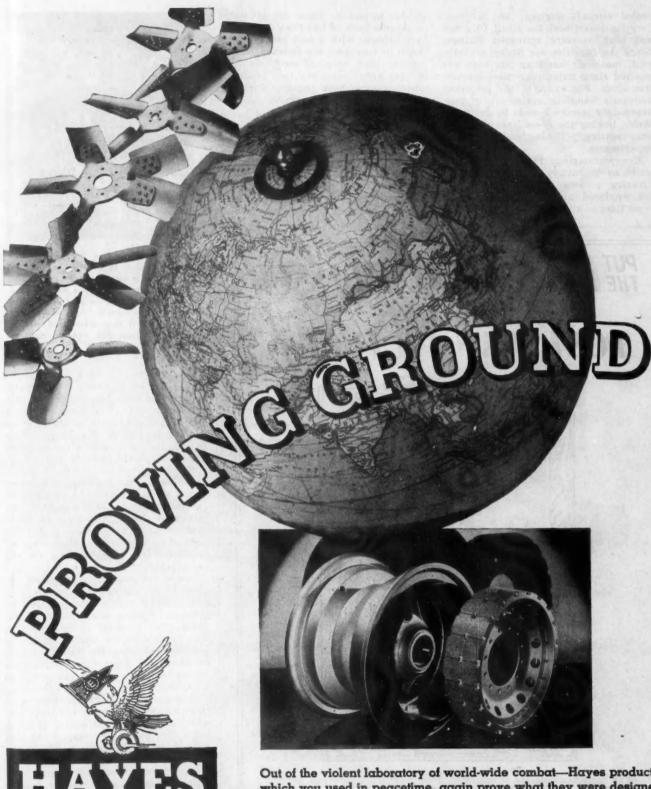
The separator consists of an endless belt run above a vibrating shaker tray which tends to disentangle the scrap. Mounted between the belt pulleys are a series of powerful electro magnets having alternate polarities. Scrap "jumps" from pole to pole causing a jolting action which completes the disentanglement and allows any nonferrous material to fall back on to the belt. The ferrous particles are held to the underside of the belt until they pass out of the magnetic field, at which point they drop off. The non-magnetic particles discharge at the end of the tray.

Here's a real answer to the problem of separating entangled scrap! For more information on the type BN or other separators, write today



Dings Magnetic Separator Co. 539 E. Smith St., Milwaukee 7, Wis.

World's Largest Exclusive Builder of Magnetic Equipment



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WHEELS AND BRAKES

AUTOMOTIVE FANS MUFFLERS, MOLDINGS AND OTHER PARTS Out of the violent laboratory of world-wide combat—Hayes products, which you used in peacetime, again prove what they were designed and built for: accurate functioning and rugged service, easy maintenance, economy.

Aircraft wheels and brakes, including the famed Hayes Expander Tube Brakes on the B-29 and all U. S. 4-engine bombers — and fans on jeeps, tanks and other combat vehicles — are taking it . . . proving the right to serve well the aircraft and automobile industries in future days of civilian production.

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HAYES INDUSTRIES, INC.

Home Office: JACKSON, MICHIGAN, U.S. A.

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Heavy stampings for the baffles are made on a battery of three 250-ton Clearing presses. Smaller stampings are produced along three lines (six press lines in all) of mechanical presses

of various makes. These are arranged in parallel lines of two rows of presses, back-to-back, with a belt conveyor between to transport the finished stampings as they drop off each machine. In this area there are two Lindberg conveyor type heat treating furnaces for handling the heavy stampings.

The press forging department has a large array of presses of various makes, including Ajax, National Maxipress, Cleveland. Each press is served by a furnace for pre-heating billets to forging temperature. One of the major activities in this department has been the production of millions of small fittings for high pressure hydraulic



Towering 5000-ton Lake Erie hydraulic press is one of a battery producing a large variety of stampings in Louisville. This press—said to be one of the largest in the industry—is served by individual tables which are scheduled under the ram from the master control panel.

lines for aircraft. This department is served by an extensive heat treating department with immersion salt baths and Lindberg pit-type furnaces. At the end of the process is a washing and degreasing station, featuring a large Detrex degreaser with a conveyor system for handling parts in and out.

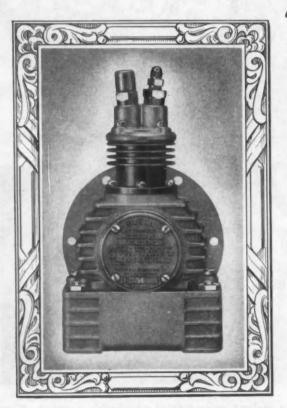
Final operation is the machine polishing and burring department where all stampings and forgings are carefully burred and polished. Adjacent to this is the final inspection department. The parts are delivered here after washing or degreasing and are inspected while moving on convevor tables.

One of the interesting corners of this plant is the pattern shop which is responsible for producing equipment for press and forging dies. Forms are produced, first in wood or molding clay, then transferred to plaster casts. The plaster casts then are finished exactly to size and form and dimensional fidelity and are ready for casting in Kirksite.

It may be noted briefly that many other finishing processes and techniques essential to the manufacture of aluminum alloy parts are found in the Reynolds plants. We refer to the extensive facilities for etching baths, for refrigeration of certain parts, and numerous large spray booths for the application of protective undercoatings.

Little has been said about the details of the metallurgical treatment associated with the fabrication of aluminum alloys. The reason lies in the fact that some alloys do not require heat treatment while others take considerable processing, depending entirely upon the type of alloy. To touch upon heat treatment in this plant would imply an analysis of many specifications and would be beyond the scope of this article. Suffice it to say, how-

THE BUELL AIR COMPRESSOR IN YOUR POST WAR PICTURE



Why not investigate the possibilities of the Buell Air Compressor for your Post War Production. The many ways in which it can serve your needs may surprise you. Thousands are in active service in Canadian fighter and bomber planes. Their precision workmanship, demanded in aviation products, assures long service without frequent parts replacement. Designed for compactness and light weight, they will fit into surprisingly close quarters. Put air to work! It is clean, powerful and reliable. Write us, advising all details as to volume and pressure, etc., and our engineers will gladly aid you in solving your problem. We specialize in small, high speed compressors of the highest quality.

BUELL MANUFACTURING CO. Dept. AA 2975 COTTAGE GROVE AVE., CHICAGO, ILL



It is significant that the designer of Sterling's new Viking Diesel Engine has chosen Chicago Rawhide

"Perfect" Oil Seals to protect the vital bearings of this unit. • These seals are used on the fuel

pump, crankshaft, the valve tappet housing and reverse gear housing of not only the Viking but of

many other modern Diesel engines. • This is another instance of "Perfect" Oil Seals contributing

to the modernization of mechanical equipment.

CHICAGO RAWHIDE MANUFACTURING COMPANY

1310 ELSTON AVENUE . CHICAGO, ILLINOIS

PHILADELPHIA . CLEVELAND . NEW YORK . DETROIT . BOSTON PITTSBURGH . CINCINNATI

65 Years Manufacturing Quality Mechanical Leather Goods Exclusively and New Sirvens Synthetic Products

Get the suggestions of CHICAGO RAWHIDE ENGINEERS on the sealing problems involved in your post-war products

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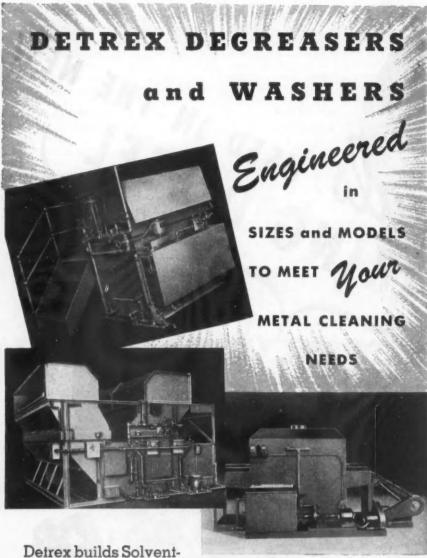
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September 15, 1944 When writing to advertisers please mention Automotive and Aviation Industries

85



Detrex builds Solventvapor Degreasers ranging from small, hand-operated models up to the largest, fully conveyorized machines... Washers of the smallest singlestage designs up to conveyorized multistage machines with all auxiliary equipment.



Chemicals for efficient use in all types of metal cleaning machines and procedures are also supplied by Detrex. Write for literature.



ever, that complete facilities are available for annealing, quenching, refrigeration, solution treatment, age hardening, etc., and that these processes are controlled within specification limits by modern automatic temperature control instruments.

Similarly, owing to the extent of the mechanical operations and further amplified by the variety of parts produced, it has been feasible only to give a word picture of but a few of the interesting highlights. For a better visualization of many of the activities in all the departments touched upon, we have selected a variety of pictorial views.

ACWP Wins Special Honorable Mention

One of eight special honorable mentions for cooperative services to business men by trade associations was awarded by the American Trade Association Executives to the Automotive Council for War Production, according to an announcement by Secretary of Commerce Jesse Jones, of the Trade Association Executives jury of awards.

Representing over 500 automotive companies, the Automotive Council's work was considered on the basis of its overall value to the successful prosecution of the war, through removing peacetime barriers to industry-wide teamwork without diminishing the individual freedom and responsibility to

ximum production.

The jury of awards also considered such additional Council functions as the systematic interchange of information on production methods among companies producing kindred products; the gathering and indexing of information on available tools for sale or lease; the reporting service covering available capacity for the manufacture of gages, tools, dies, jigs and fixtures; the assembling of industry-wide information for application to pressing manpower problems; and the special information services set up to keep war contractors fully informed on government policies, rules and regulations.

The awards in this, the eleventh annual competition sponsored by the Executives, will be formally presented at a meeting of the Trade Association Executives group at New York in No-

vember.

Metals Society to Receive Ordnance Award

The American Society for Metals will receive the Ordnance Distinguished Service Award in recognition of its contributions to the war effort, according to word received by W. H. Eisenman, national secretary of the Society, from Major General L. H. Campbell, Jr., Chief of Ordnance.

The award recognizes the Society's overall efforts to speed war production through metals education and training

work.

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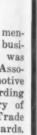








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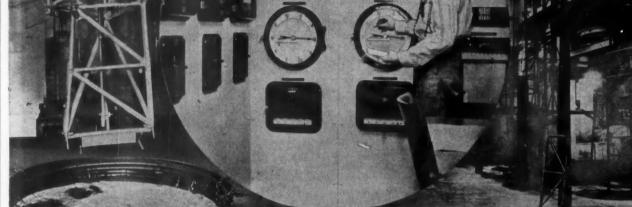
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Jigged to prevent distortion, this welded member for the nacelle of a Beechcraft plane plunges from its Micromax-controlled vertical furnace into oil quench. Quenching is complete in 5 to 8 seconds.

Beech Aircraft's centralized control room in which are located the Micromax Pyrometers to regulate all heat-treating temperatures. The foreman is consulting the Pyrometer for the vertical nacelle-furnaces.

BEECH INCREASES HEAT-TREAT EFFICIENCY By Centralizing Its Micromax Controllers

Heat-treating operations performed in the Beech Aircraft Corp. plant at Wichita, Kansas, include case hardening, annealing, normalizing, stressrelieving, hardening, etc. The job of automatically controlling the temperatures of these operations has been turned over to Micromax Pyrometers, with the result that their microresponsive control is giving Beech routinely dependable heat-treatment.

For utmost efficiency, instruments are centralized in a specially-designed control room. Here all Micromax Controllers have the same ambient temperatures; all operating conditions are standardized; one man keeps all temperatures under his eye. The room is supplied with air at a slight positive pressure so that dust and fumes cannot enter-a valuable time-saver when pyrometers, hardness testers and other instruments are to be kept at optimum accuracy and dependability.



Irl Ad N-33-620(9)

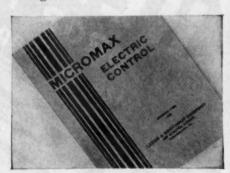
Instrumentation of Vertical Furnaces

Typical of the special equipment employed is that for airplane nacelles. These are hardened in vertical furnaces, set well up in the air and directly above the quench tanks. The furnaces are muffle units, gas fired and supplied with specially prepared atmosphere to prevent oxidation or other change of the plane parts. Nacelles are quenched through doors in the furnace bottoms.

These furnaces have three firing zones, each with its Micromax Controller. In the round picture above, one group of three Controllers can be seen directly below the clock; the top and bottom instruments, on the first and third zones, are Indicating Controllers, while the middle zone has the Recording Controller which the foreman is examining.

These instruments bring microresponsiveness to temperature regula-

with the appearance of heat lags or surges, the fuel valves are adjusted to bring temperature back to the control point. Equipments incorporate the outstanding features of Micromax design: sturdy machinetype parts; extra-heavy gears, shafts bearings; fine construction and throughout.



Further information will be sent on request; either a general catalog or tion, so that almost simultaneously specific engineering data, as you prefer.



New Products

Industrial Oscillograph

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has developel an industrial oscillograph for use by aircraft engine manufacturers, research laboratories and electric power companies. Electrical phenomena too rapid for observation by any other means can be caught by this instrument which has made possible many recent advances in design of aircraft engines, circuit breakers and other protective devices. In this oscillograph a 50,000 volt electron beam generated in a cold cathode tube impinges directly upon a fixed or rotating photographic film to give a sharp, detailed record of electrical phenomena lasting as little as a fraction of a milionth of a second. A photoelectric control for exposing the film carried on the rotating drum insures that the film will be exposed for one revolution only, although the drum speed is variable



Westinghouse oscillograph

within a wide range up to 7,000 rpm. Electrical phenomena ranging from the spark of an ignition system to lightning striking a transmission line are investigated with this new oscillograph.

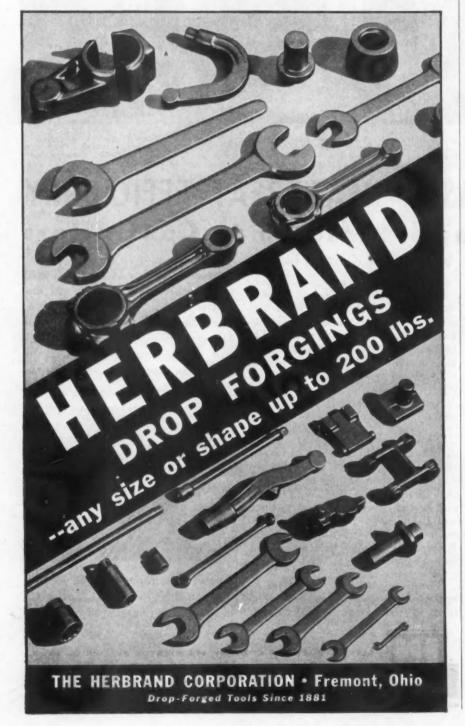
Two New Pesco Products

Pesco Products Co., Cleveland, Ohio, has recently announced two new developments in the automotive equipment field.

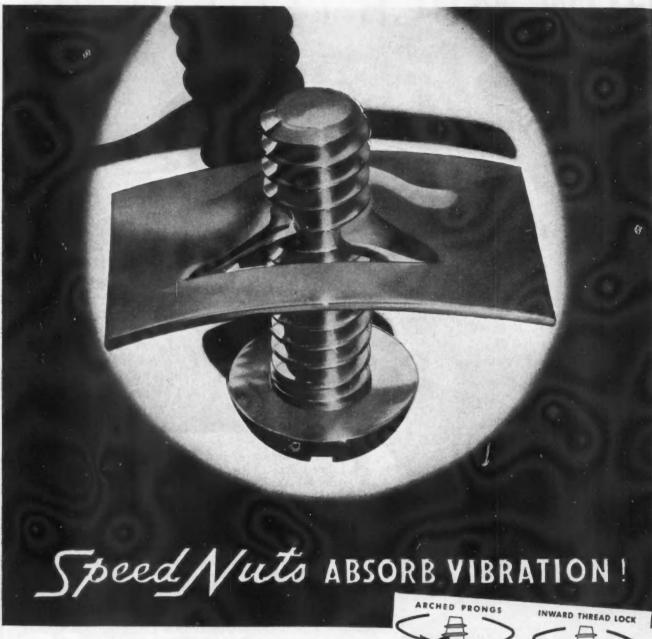
The clutch actuator produced by Pesco was designed to eliminate the friction so common in the type of clutch release ordinarily used today. It is said that the clutch pedal pressure is reduced by more than one-half, by the elimination of friction, while at the same time the device offers a cost saving of like proportions.

The hydraulic system is so arranged that an automatic adjustment occurs on every engagement of the clutch while a metering valve provides the exact clearance for the release bearing. This permits full wear of the clutch lining without any maintenance cost for clutch pedal adjustment and provides a mechanism where slipping clutches cannot be encountered due to improper adjustment.

The Pesco brake intensifier has been (Turn to page 91, please)







One of the deadliest enemies threatening the life of most products is VIBRATION. The only self-locking nut that conquers destructive vibration by ABSORBING it, is the SPEED NUT.

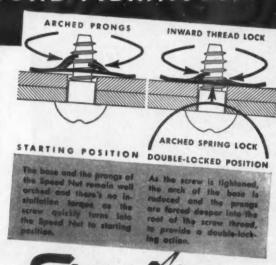
Made of LIVE spring steel, accurately heat treated, the SPEED NUT has two arched prongs that cushion and ABSORB the most severe vibration, to definitely prevent vibration loosening.

In addition, SPEED NUTS are extremely light in weight. They are quickly and easily applied. And they cost considerably less than other fasteners.

Small wonder, then, that millions of SPEED NUTS were used prior to the war, on automobiles, radios, stoves, refrigerators and thousands of other products... more are being used today on all types of military equipment... and more than ever before will be used after the war is won. A brief letter will bring you full details.

TINNERMAN PRODUCTS, INC. 2059 FULTON ROAD . CLEVELAND 13, OHIO

In Canada: Wallace Barnes Co., Ltd., Hamilton, Ont. In England: Simmonds Aerocesseries, Ltd., London

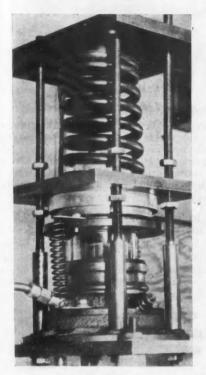


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New Products

(Continued from page 88)

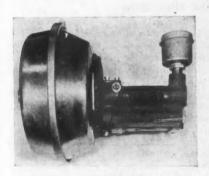
designed to provide a unit for power braking on trucks and buses that will permit faster acting brakes, lower pedal pressures and simplified installa-



Pesco clutch actuator

tion. It produces in the hydraulic brake system a pressure of 1500 psi at a pedal pressure of 50 lb.

It is designed as a self-contained unit and can be placed anywhere on the chassis, inasmuch as it requires no specific location relative to either the brakes, master cylinder, or pedal. It is merely placed anywhere in the line be-



Pesco brake intensifier

tween the master cylinder and wheel cylinders. Being a self-contained unit, there are no brackets that have to withstand the reactions of the braking force, there is a minimum of piping required, and there are no levers or rods.

The assembly consists of a vacuum

suspended diaphragm connected to a piston in a hydraulic cylinder. When the driver operates the master cylinder in his hydraulic brake system, thereby producing a pressure in the master cylinder to wheel cylinder lines, the pressure so produced shuts off the vacuum and admits air to one side of the diaphragm.

This sets the diaphragm in motion and thus the piston is moved in the hydraulic cylinder which pumps into the brake lines and increases the line pressure. An automatic valve arrangement prevents the increased pressure from being applied back to the master cylinder. The arrangement of the valving is such that the master cylinder reaction permits the driver to have a constant "feel" of the magnitude of the braking forces being applied.

Type "J" Direct **Current Micromotor**

A new direct current Micromotor, designed especially for the heavier tasks in automotive heating, ventilating and air conditioning, and available in sizes from 1/20 up to 1/10 horsepower, is being offered by the A. G. Redmond



Grumman engineering ingenuity makes effective use of remote Controls on the new Hellcat to prevent landing gear retraction when plane is on the ground. Pilot's control lever cannot be moved to the retract position until the compression load is removed from the oleo strut which occurs in flight only.

An Arens flexible remote control is performing this vital function which has eliminated the possibility of pilot error and is safeguarding the Hellcat from accidental mishaps.

Arens Controls, Inc., has specialized in the manufacture of quality remote controls for over 20 years and invites your inquiry.

Write for catalog and enclose details on your problem. One of our engineers will submit a control design engineered to your individual application.

ARENS CONTROLS, INC.

2256 South Halsted Street, Chicago 8, Illinois







For SWING FRAME GRINDERS -Booth Type Exhaust Hoods plus ROTO-CLONE Dust Collectors

Booth type hoods provide the most practical and positive method for exhaust of swing frame grinders. Type D Roto-Clones maintain the necessary air flow to prevent dust escapement and to efficiently collect the entrained dust. The five booths shown, exhausted by number 24 type D Roto-Clones with a capacity of 1500 cfm, do an excellent dust control job.



Send for complete engineering data and Bulletin No. 272 which describes the superior performance characteristics of the Type D Roto - Clone dynamic dust precipitator. There is no obligation.

Company, of Owosso, Michigan.

Known as the Type "J" direct current Micromotor, this unit will displace up to 600 cubic feet per minute with blowers and up to 2400 cubic feet per minute with fan applications.

Modulated magnetic field design is



Type "J" micromotor

said to cut out mechanical and magnetic noises and eliminate vibration. Cushion mounted armatures maintain quiet operation. Extra large capacity reservoirs help protect bearing life by supplying lubrication for an unusually long period of time.

Glove Resists Acids, Oils and Caustics

A new neoprene Stanzoil glove of light weight, for use in light assembly and inspection work and in food industries, has just been announced by The Pioneer Rubber Company, Willard,



Stanzoil glove

Ohio. This new glove, while thin for greater finger-tip sensitivity, is tough and durable, designed for snug fit and comfort. Fingers have a new non-slip finish for firm easy gripping of oily objects. Made of neoprene which resists damage from oils, acids, and caustics Stanzoil neoprenes are made in sizes 7 to 9.

Silver Plating On Aluminum

Silver may now be deposited electrolytically onto aluminum or aluminum alloys by means of a simple method, known as the Preplate process, a development of Colonial Alloys Company, Philadelphia, Pa.

Silver deposits of considerable thickness can go directly onto the aluminum surfaces, or follow a copper, nickel,

zinc or cadmium deposition.

The aluminum is thoroughly cleaned as prescribed, passivated, immersed in Preplate solution for a few seconds, and then electroplated in the usual manner, using the regular equipment found in all plating shops.

"Cell-Tite" Has High Strength-Weight Ratio

The Sponge Rubber Products Company, Derby, Conn., has released information on its product "Cell-Tite" which until quite recently has been manufactured exclusively for war uses. Cell-



AMERICAN AIR FILTER CO., INC.

449 CENTRAL AVE. LOUISVILLE, KENTUCKY IN CANADA, DARLING BROTHERS, LIMITED, MONTREAL, P. Q.



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Tite is an ebony-like, cellular rubber material having a high strength-weight ratio. Made in various weights from 8 to 20 lb per cu ft, it has more buoyancy and lower water absorption than cork, with excellent thermal, electrical and sound insulating qualities.

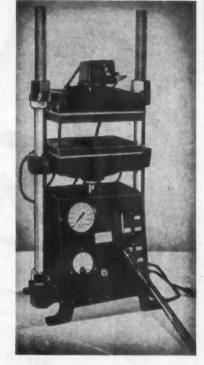
Press for Laboratory Use

The Wabash hydraulic press No. 975, made by Laboratory Specialties, Inc., Wabash, Ind., is designed for all types of general laboratory use in the testing of materials. The hydraulic mechanism provides a total available force of 24,000 lb, with attached pressure gages to measure the indicated psi ram

pressure. The platen is 7 in. by 10 in., width between columns is 11 in., stroke is 8 in. and height is 36 in. The press weighs 225 lb.

A continuous temperature indicator of the thermocouple type indicates the temperature accurately enough for most purposes. Thermometer wells are drilled in the platens to accommodate a regular mercury thermometer which will permit greater accuracy and provide for checking the scale reading of the millivoltmeter attached to the thermocouple.

The press is available without electric heating platens or temperature indicating means.



No. 975 Wabash hydraulic press

Rechargeable Wet Flashlight Battery

A rechargeable wet flashlight battery for industrial use built on the principle of the automobile wet storage battery is announced by The B. F. Goodrich Company, Akron, Ohio. A freshly charged wet battery will give about three hours of constant light. Batteries

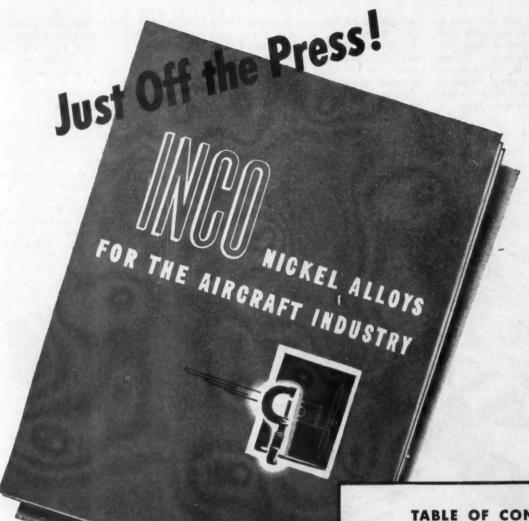






can be used in the standard three or five cell dry battery case with the use of spacer plugs.

The new wet battery requires a special type Mazda Lamp, which comes in 1.9 v; .6 amp of screw base and flange



When you are searching for a metal to withstand some unusually destructive set of service conditions . . .

The answer can often be found among the Inco Nickel Alloys.

Their properties are summarized in this new booklet so that you can find the important facts and data right at your finger-tips when you encounter difficult metal problems in your work.

Write for your copy today.

INCO NICKEL ALLOYS

MONEL . "K" MONEL . "S" MONEL . "R" MONEL . "KR" MONEL . INCONEL . "Z" MICKEL . NICKEL Sheet ... Strip ... Red ... Tubing ... Wire ... Castings

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THIS COUPON

THE INTERNATIONAL NICKEL COMPANY, INC. 67 Wall Street, New York 5, N. Y.

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base design. This is a 600 mil lamp as contrasted with the 300 mil lamp used with dry batteries. Actual wattage consumed with the wet battery is 50 per cent more than with the dry type and since light is directly proportional to watt consumption the wet batteries give a brighter light than the older type.

Free Flowing Solder For Aluminum

Sheet aluminum can now be lockseamed, or lapped and spot-welded or riveted, and the joint sealed with a new free-flowing solder, EutecRod 199, just introduced by Eutectic Welding Alloys Co., New York, N. Y. Used with Autochemis Eutector Flux 199, Eutec-Rod 199 is said to flow on aluminum as readily as ordinary lead-tin solder on tin-plate, brass or copper.

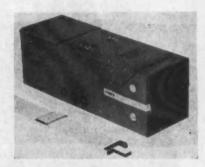
In long laps it will make joints of moderate strength, but it should generally be used as a seal. This rod will work on cast aluminum as well as on wrought aluminum, and on steel, copper and nickel alloys. EutecRod 199 is suitable for applications where the completed joint will not be heated over the boiling point of water under working conditions. Its low temperature of

application, 400 F, makes it possible to join thin sheet metal without danger of distortion. EutecRod 199 will even bond to cast iron, if the iron has first been "tinned" with a zinc-base solder.

Miniature Oscillograph

A self-contained, compact, permanent-magnet oscillograph has recently been originated by the General Electric Company, Schenectady, N. Y. Known as the Type PM-17-A1 and originally designed for a war application, it has now been adapted for general use.

It consists of three principal systems: first, the optical system; second, the six parallel galvanometer channels; and third, the photosensitive-material



Type PM-17-A1 G-E oscillograph

transporting mechanism with internal motor and removable film holder, which are all enclosed within a light-tight metal case 4½ by 4½ by 14 in. The weight of the complete instrument is approximately 10 lb.

Rust Inhibitor Has High Melting Point

A rust preventive coating for protection of metal parts and equipment during storage, shipment, and, in some cases, in service, is being marketed by Witco Chemical Company, New York, N. Y. Known as Witco No. 673 rust inhibitor, this new product has been approved by Army Ordnance Specifications AXS-673, Revision I, Amendment 2. It is a cold-dip, rapid drying coating that may be applied either by dipping or spraying, as its viscosity is comparable to that of water. It is said to be non-abrasive, non-corrosive, and easily removed with ordinary solvents.

A feature of Witco No. 673 Rust Inhibitor is its high melting point—in excess of 250 F—and yet the coating remains flexible at temperatures of —20 F.

Thiokol "ST", a New Synthetic Rubber Blend

Low temperature flexibility without the addition of plasticizers, plus excellent resistance to solvents, ozone and sunlight are said to mark Thiokol "ST," a new type of synthetic rubber devel-



Ready to Use ...

JOHNSON General Purpose Bearings save precious time in many ways. When you place your order you have over 800 sizes to choose from. This enables you to buy exactly according to your needs. Every General Purpose Bearing is completely machined inside—outside and ends. Thus they are ready for immediate installation. There is no extra machining . . . no cutting down . . . no excess stock to remove. Oil grooving, slots or holes are easily, quickly and economically added when necessary.

When properly installed, Johnson General Purpose Bearings will deliver a maximum of service with a minimum of attention. The next time you need plain, cast bronze bearings—call in your local Johnson Distributor. Permit him to show you how to save both time and money . . . how to avoid waste and delay by specifying Johnson General Purpose Bearings.





THE FORMICA INSULATION COMPANY 4612 Spring Grove Avenue, Cincinnati 32, Ohio

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Large hollow steel aircraft pro-peller blades, after several heat treating and forming operations, are heated for drawing or stress relieving in EF circular convection pit type furnaces similar to those shown at left and below.*

Fans in the motor operated covers force the atmosphere down between baffles and the heating elements and the heat up through the charge. The material is heated uniformly throughout the entire charge, the full length of the blades.

Other products in various shapes and sizes including wire, tubing, forgings, stampings, castings, etc., are uniformly treated in EF pit type furnaces and other EF continuous and batch type installations.

Submit your production turnace problems to EF engineers—it pays

THE ELECTRIC FURNACE CO., SALEM, OHIO

Gas Fired, Oil Fired and Electric Furnaces—For Any Process, Product or Production



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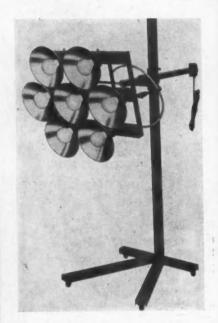
Aluminum Brazing Annealing Billet Heating Bright Annealing Bright Hardening Copper Brazing
Controlled Atmosphere Carburizina Drawing Forging Malleablizing Silver Soldering Nitriding Normalizing Soaking Pits Scale-Free Hardening Quenching Machines Ceramic Kilns, etc. Process Heati

We Build the Furnace to Fit Your Job ELECTRIC FURNACE CO. SALEM, OHIO

oped by the Thiokol Corporation, and produced at the Thiokol plants of the Dow Chemical Company, Midland, Mich., and of Naugatuck Chemicals, Ltd., Elmira, Ontario, Canada. The new "ST" is said to be the first successful solution to the problem of "cold flow" among the polysulphide synthetics, having marked resistance to this tendency of taking on a permanent deformation under pressure or stress.

Portable Radiant **Energy Equipment**

Fostoria Pressed Steel Corporation, Fostoria, Ohio, has placed on the market a portable infra-red unit designed to supply radiant energy to facilitate baking, drying, dehydrating and pre-



Model P-7-IR infra-red unit

heating operations. This unit, the Model P-7-IR, may be used singly or in multiple assemblies.

Adjustable features of the cross-arm on the upright and the reflector yoke allows the radiant energy to be directed at various angles from a height of 18 in. to 6 ft.

Self-Flaring Coupling For Plastic Tubing

A self-flaring coupling for flexible plastic tubing is now being delivered by Packless Metal Products Corporation, New Rochelle, N. Y. No flaring tools are required. The flare is formed as the members of the coupling are screwed together in one operation, assuring uniform walled flare, with no thinning toward the end. The plastic tubing is not preheated.

It is claimed by the manufacturer that the construction, by providing a union effect, eliminates twisting and distortion of the tubing in installation, The Simmonds Hydraulic Fise

[Quantity Measuring Type]

[Quantity Measuring

Again Simmonds pioneers . . . this time in the development of a successful hydraulic fuse for the positive protection of vulnerable hydraulic lines.

What the manufacturers and users of hydraulic systems have long been looking for — a safety shut-off device to protect the system from complete failure in the event of a ruptured line — is now available in the Simmonds Hydraulic Fuse for aircraft hydraulic systems and for various industrial applications.

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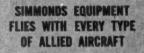
ion.

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The function of the Simmonds Hydraulic Fuse can be likened to that of the electric fuse. Neither fuse affects normal operation of the system. But when the flow in either circuit becomes excessive, the fuses act to shut off the lines they protect.

Quickly installed, the Simmonds Fuse is light in weight (approximately 3 oz.). It operates successfully regardless of variations in either oil viscosity, pressure, or rate of flow. Also, it is not affected by back pressure, surges, or large amounts of air left in the system by incomplete bleeding. Of the quantity measuring type, it is intended for two-way flow lines. Successful installations of the Simmonds Fuse as a delayed action restrictor valve have also been made, greatly simplifying hydraulic cylinder design.

All parts manufactured in accordance with AN specifications, the Simmonds Fuse is being specified for many of America's leading aircraft. For further details on its construction, installation, and sizes, write today for free folder.



Automatic Engine Controls
Push-Pull Controls
Hydraulic Accumulators
Hydraulic Fuses
Chronometric Radiosondes
Spark Plugs
Self-Aligning Rod-End Bearings
Fasteners and Clips of

Specialized Design



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as well as split ends. Coupling may be reused indefinitely. For tube sizes 1/4 in. to 3/4 in. OD.

Commutators Made by Plating on Plastics

Intricately designed commutators, using metal plating on plastics, are now in production at the Metaplast Co., New York, N. Y.

It is possible to mold various and odd-shaped thermo-setting or thermoplastic commutators by molding-in or machining grooves and depressions wherever contact surfaces are desired. These grooves and depressed areas are then built up flush with the non-conductive surface by Metaplating silver or any other desired metal. The commutating surface is then ground mirror smooth, which affords a one-piece unit of conductor and non-conductor in any shape or type desired with practically any commutating contour.

Portable Power Grease Gun

An Alemite electric portable power grease gun, Model 7190, is the latest addition to the Alemite line of the in-

dustrial Alemite division, Stewart-Warner Corporation, Chicago, Ill.

The new gun has been developed to deliver fast, positive high pressure lubrication with all types of lubricants that seek their own level. Equipped with large heavy duty wheels for easy mobility, operation is further facilitated by means of a ball bearing front caster in the steering mechanism.

A quiet driving device connects the



Alemite power grease gun

heavy duty 1/3-hp electric motor to a high pressure grease piston and cylinder. A mercury switch automatically shuts off the motor when a pressure of 5,000 psi has been built up in the delivery hose.

Speeds Plane Loading



At key points along United Airlines system, Clark Forklifts are speeding the loading and unloading of Main-

liners and Cargoliners.
The Forklift is a new plane-wader model developed by Clark Tructractor of Battle Creek, Mich. Its hydraulic hoist will lift a capacity load of 4000 lb. to a height of 12 ft; and as a tractor, it will haul a train of three loading tubs at better than 10 miles per hour.



BORG & BECK DIVISION

BORG-WARNER CORPORATION



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*Data sheets showing complete code number for units having a specific capacitance value and volt-

age ratings available on request. **Other tolerances available.

TOMORROW

Freedom and a Good Society

(Continued from page 15)

years. But as time went on, we forgot that government was a delicate and complicated mechanism and that liberty could not be preserved without effort. We began to flirt with various isms imported from Europe and to substitute collectivism and statism for individualism and economic freedom. . . . We did these evil things in the name of Progress, Humanitarianism, and Social Justice.

The great obstacle that prevented the substitution of the embalmed remains of the father of communism for the Goddess of Liberty was the United States Constitution. That obstacle has been removed. The Constitution has been scuttled and now lies rotting at the bottom of the ocean of human history.

Two courses are open to those of us who believe in liberty. Either we must secure control of an existing (political) party and clean out the socialists and communists in it, or we must form a new party that will take a bold and unequivocal stand for economic freedom. This party must abandon appeasement and compromise and clarify the great issue to be decided.

No party of enlightenment can succeed unless there is a large body of enlightened citizens. Our success therefore demands a mammoth educational program which will reach into every hamlet, shop, church, school and home. People must be taught that their interests are better served by abundance than by scarcity-and that all government regulations promote scarcity. They must be taught that it is impossible for government to provide social gains or general benefits-all government can do is to benefit some by in-juring others. They must be taught that while an honest government will take away some alleged benefits, it will also relieve them of paying taxes to give benefits to others. They must be taught that they can spend their own money more advantageously than the government can spend it for them. They must be taught that government controls lead to dictatorship.

They must be taught that history has demonstrated the folly of government controls. They must be taught that it is wicked and immoral to accept special privileges and bribes from the government.

Will those of us who believe in freedom accept the challenge? Are we able to organize ourselves for the preservation of the Republic? I hope so. The stakes are high and we owe it to the boys who are fighting for us to preserve the freedom they are fighting for.

From an address before the Pennsylvania Bankers Association.

Douglas and Martin Feederline Planes

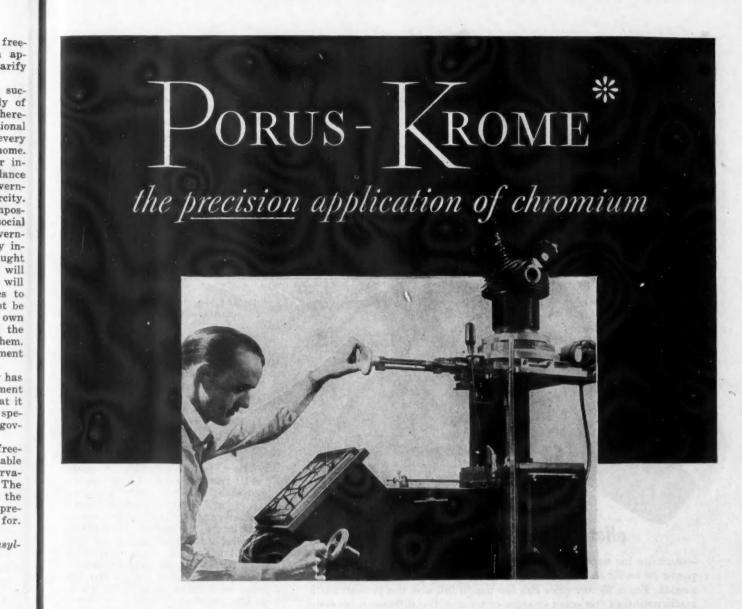
(Continued from page 27)

ing forward and the other with opposed seats. Both arrangements provide a luggage compartment beside the entrance hatch for passengers' hand luggage, making it available at all times.

The Model 202 has a design gross weight of 32,500 pounds for all versions except the 202-15, which is 33,500 pounds, and is designed for an average operating range of 500 miles carrying a 50 per cent fuel reserve.

A cost analysis shows that direct flying costs for the 202-11 and 202-12 operating over this range at 60 per cent power will come to \$117.31 per hour, divided as follows: fuel, \$25.40; oil, \$1.38; plane depreciation, \$7.76; engine depreciation, \$3.07; engine overhaul and repair, \$7.37; plane overhaul and repair, \$6.49; plane and engine ground service, \$7.20; first pilot, \$11.10; co-pilot, \$5.60; cabin attendant, \$2.29; crew expense, cockpit, \$1.02; cabin, \$.78; plane insurance, \$4.29; passenger service, \$33.90. Direct flying cost per mile is calculated at \$.519, direct flying cost per ton mile at \$.154.





Every step in the production of Porus-Krome is a precision operation . . . and each one is carefully checked. Each operation adds its peculiar influence to the characteristics of the finished product.

So important are the surface characteristics of Porus-Krome that it requires precision optical instruments like the recording internal viewing machine shown above to adequately check them.

The percentage of porosity and its uniform distribution are particularly important in cylinders

for airplanes . . . where piston speeds, brake mean effective pressures, and temperatures are high.

Van der Horst personnel are specially trained and thoroughly experienced in this precision work through having processed thousands upon thousands of cylinders, both Diesel and gasoline, for the Army and Navy in the past four years.

Let Porus-Krome give greater reliability and longer cylinder life to your engines. Write for full information.

PORUS - KROME VAN DER

Good for the Life of your Engines



VAN DER HORST CORPORATION OF AMERICA CLEVELAND 11 - OHIO

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—such as his super-charger "cutting in," to give him that extra power he needs at certain altitudes. Or "cutting out," when it isn't needed. For a fighter pilot has his hands full and the precise, automatic action of the super-charger can mean the difference between victory and defeat—life and death.

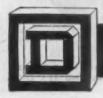
One of America's outstanding fighter plane builders put the question to a Square D Field Engineer. "Can you furnish us with a compact, lightweight device which will do the job—automatically, accurately and consistently?"

Square D's answer was a specially designed Aneroid (altitude pressure) Switch. It weighs 24 ounces. It "cuts in" and "cuts out" engine super-chargers at predetermined altitudes. It's a typical example of Square D designing and building, guided by the Field Engineer's accurate diagnosis and interpretation of the job to be done.

Let a Square D Field Engineer Help You

In the face of today's manpower shortage, peak efficiency of your electrical control and distribution system is vital. It will be equally important in the highly competitive and narrow-margin years ahead. Now is the time to profit most by the counsel of your nearest Square D Field Engineer. This service is available through Square D branch offices in nearly 50 principal U.S. and Canadian cities.





SOURKE D COMPANY

DETROIT

MILWAUKEE

LOS ANGELES

New Weapons Revealed

(Continued from page 44)

tracks make possible the distribution of its weight over a broad area, and the carrier will remain on top of ground that would ordinarily bog down a vehicle of similar weight. The Weasel can

climb grades of 45 deg.

The vehicle is 141/4 ft long and 51 in. high. It resembles a cross between a low-slung automobile and a boat. The driver sits behind the bow with the instrument panel at his right elbow. The engine is behind the panel. Space at the rear accommodates three passengers, or cargo. Two levers in the driver's compartment control the steering. Each lever is linked to a brake on the steering differential. For water travel, direction is controlled by a cable running to two rudders at the rear. These rudders are hinged and can be swung upward, out of position, when the vehicle operated on land.

Because of its light ground pressure, wide tracks, squat design, overall light weight, and six-cylinder Studebaker Champion engine, the unit is particularly valuable in battle areas where mud, swamps, sand, water barriers, and rough terrain make motorized traf-

fie difficult.

Revision in design has made the "Weasel" adaptable to many additional military tasks, including commando raids; transportation of men, materiel, and casualties over direct off-the-road routes, and aircraft rescues. Special brackets are used to convert the vehicle into a four-patient litter carrier.

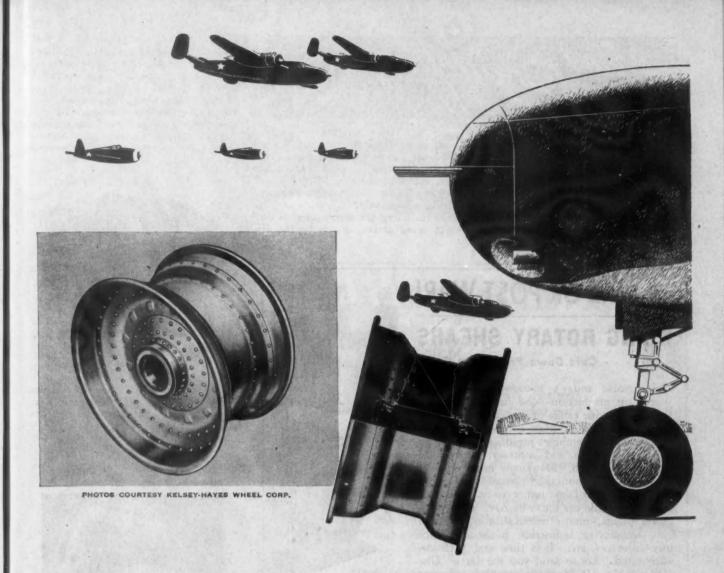
Probably the most spectacular development announced is the small seventon airborne "Locust" tank produced by Marmon Herrington Co. It has been given a classification as M-22. Its use in the paratroop invasion of France has shown it to be the most flexible weapon used against the Germans. The "Locust" mounts a 37 mm cannon and a .50 cal machine gun, and is flown to the battle area in gliders.

Development and disclosure of these new weapons, all of which are now fighting in Europe, has been under the supervision of the Office, Chief of Ordnance—Detroit working with the vari-

ous manufacturers.

BOOKS ...

First edition of the COST ACCOUNT-ANTS' HANDBOOK, edited by Theodore Lang, has been published by the Ronald Press: It deals primarily with cost accounting for the manufacturing industries, a field in which the art has gained its greatest maturity. The treatment of subject matter, however, has been so developed as to make the text of value not only to cost accountants but to engineers and production men as well. The subject matter has been systematically divided into twenty-five major sections, covering the gamut of topics which constitute modern cost accounting practice.



Challenge to lightweight non-ferrous metals-

BY N-A-X 9100 SERIES STEELS

The challenge of non-ferrous "lightweight" metals in reducing weights to a minimum in the aircraft industry has been met through the use of N-A-X Alloy Steels in the above pictured aircraft landing wheels made entirely of N-A-X 9120, including the cold

Through the ingenuity of the wheel manufacturer, and by utilizing the recognized outstanding properties of the N-A-X 9100 Series Alloy Steels, these wheels are lighter in weight, and stronger than the products they replace.

Outstanding cold forming properties of the metal combined with its response to exacting heat treatment are demonstrated by this application.

N-A-X 9100 Series—the original alloy-saving steel -no doubt can be used to the same advantage in some of your products. Write to us for information regarding this versatile alloy steel.



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GREAT LAKES STEEL CORPORATION

DETROIT 18, MICHIGAN

Sales Offices in Principal Cities

Division of NATIONAL STEEL CORPORATION Executive Offices, Pittsburgh, Pa.



New Products for Aircraf

Eclipse A-C Power Supply Systems

Eclipse a-c power supply systems consisting of variable frequency alternators, carbon pile voltage regulators and compounding units are designed to provide a source of either constant or variable frequency for a-c power or for rectified d-c power. At the present time two models are available, rated at 25 kva, 18.75 kw and 66.6 kva, 50 kw. They weigh 49 lb and 129 lb, respectively.

By installing the alternators on constant speed drives, driven by the aircraft main engines, a source of constant frequency is available. Rectified d-c power can be obtained from either constant or variable speed operation over the rated operating speed range of the alternators. Consequently, increased d-c power is thus available over conventional d-c power supply systems.

The Eclipse carbon pile voltage regulators provide continuous regula-



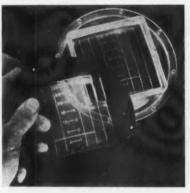
Eclipse 66.6 kva alternator

radio interference to a minimum. The 25 kva alternator delivers its rated output between 7200-8800 rpm, while the 66.6 kva alternator operates

tion without fluctuation and reduce

Range-Finder for **Aerial Cameras**

between 5400-6600 rpm.



Newest application of Plexiglass is an aerial camera range-finder, which guides reconnaisance photographers in gauging the field which their lenses cover from various altitudes. Molded in a single operation, even to the mounting holes and under-cut flange, the piece is opaqued where required. Plexiglass is a prod-uct of Rohm & Haas, Philadelphia,

Lumarith Plastic Name Plates

To make certain that the markings on the instrument panel before the pilot are clearly visible by day and night, a plastics fabricator has produced identification plates made of Lumarith in combination with fluorescent ink. When the plates are viewed during the day the white ink stands out sharply and the instructions can be read clearly. At night the borders and trim on the plates drop out and only the essential word-

IN WAR OR POST-WAR!

KLING ROTARY SHEARS

- - Cuts Down Production Costs

Helps solve today's manpower problemspeeds up production—and increases output. Performs a wide range of work. Latest development in sheet and plate cutting. Durable in construction. Combines rapid operation with hairline precision and accuracy. Cuts mild steel up to 1 inch. Many new improvements in design. Economical in operation. Easy to operate. Skilled labor unnecessary. This machine is in wide use today by navy yards, ordnance plants, motor manufacturers, aviation and automotive industries, home appliance manufacturers, etc. It is time and performance-tested. Let us send you the facts. Our Bulletin No. 245 furnishes complete information. Write for it today. No obligation or

KLING BROS. ENGINEERING WORKS 1318-A9 N. Kostner Ave. Chicago 51, III.



FLANGING Make flanges, small or large. The flanging rolls are interchangeable. Due to the rigidity of the Kling Rotary Shear, smooth and even flanges can be rolled.



STRIP SHEARING OR STRIP SHEARING OR SQUARING GAUGE
This gauge can be used not only for shearing purposes, but for any other straight work such as straight joggling, straight beveiling, straight flanging, etc.



BEVELING Makes bevels, any angles. Degree of bevel can be varied. The capacity of the shear when beveling is the same as when shearing straight edges.

OVER 50 YEARS OF PRECISE ENGINEERING



PIN CIRCLE CUTTER
The Kling Pin Circle Cutter
will do the same type of work
as the clamp cutter.



CUTTERS Cuts circles. Any sizes. Lighter type has hand cranks. Heavier types provided with either manual or power operation.

CLAMP CIRCLE



JOGGLING OFF-SETTING With the Kling Attachment straight lines as well as odd shapes, including reverse curves, can be joggled or offset.

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MARMAN CLAMPS

- 1 Strength_Marman clamps hold permanently under any and all conditions.
- 2 Ease of Installation_Marman's patented design opens for quick, easy installation.
- 3 Longer Life_Marman Clamps can be used over and over without efficiency loss.

Prompt delivery . . . made of aluminum alley, stainless and cold rolled steel in sizes and shapes to fit all convex surfaces. May be had with self-locking, plain hex or wing nuts.

940 WEST REDONDO BOULEVARD INGLEWOOD, CALIFORNIA

ing, printed in fluorescent ink, can be seen.

Each plate consists of two sheets of Lumarith. The lettering is put on the first sheet in luminous ink, and the border and trim applied with regular ink. Then the second sheet of Lumarith plastic—finished with a matt surface to eliminate glare— is laminated over the printed surface to give permanent protection.

The Lumarith plastic name plates are produced by Plastic Fabricators, San Francisco, Cal. Lumarith is a product of the Celanese Celluloid Corporation, New York, N. Y.

Radio-Noise-Suppression Capacitor

A new Pyranol radio-noise-suppression capacitor, designed to reduce radio-noise voltage from generators, inverters, motors, and other equipment, has recently been brought out by the General Electric Company, Schenectady, N. Y. The capacitors are of the thru-stud type with a terminal at each end. One line of a d-c or a-c power circuit can be "fed" through the unit, thereby reducing internal inductance and resistance, and increasing filter efficiency for a given capacitance.

The capacitors are especially effective in reducing radio noise at higher frequencies.

The physical dimensions are approximately 134 by 356 in., and the unit weighs 4½ oz. The capacitors are cur-



G.E. radio-noise-suppression capacitor

rently available and are rated 0-100 amp, 250 v maximum a-c or d-c, 0.55 mf. They are designed to meet vibration tests required by U. S. Army Air Forces Specifications.

Fluid Heat Aircraft Heater

Latest addition to the SRH series of aircraft heaters of the Fluid Heat Division, Anchor Post Fence Co., Baltimore, Md., is the Number SRH-15. Its output is 15,000 Btu-hr. Cylindrical in shape, it measures 4% in. in diameter by 18% in. long. Weight is 6 lb 14 oz including controls and accessories.

The recently developed combustion process of vapor entraining utilizing a



Fluid Heat aircraft heater No. SRH-15

capillary vaporizing block in conjunction with preheated air is used in this heater. It is claimed that the flame has such stability that its characteristics are the same regardless of altitude or speed. Barometric compensation provides for uniform combustion conditions from sea level to 40,000 ft.

Composite Plastic

A composite plastic, made from a high-tensile surface material and a resin impregnated wood pulp core, has been developed by The Glenn L. Martin Company, Baltimore, Md. It can be given varying properties of strength, weight and density as desired through the proper selection of material for the outer plies and resin and filler for the core, can be easily molded to irregular shapes, and can provide special integral high density areas for special stresses such as the attachment of fittings without sacrifice of lightness or

(Turn to page 110, please)



• Wherever your new car designs now call for a jam nut—lockwasher and nut—plain washer, lockwasher and nut . . . replace with a single, inexpensive self-locking PALNUT. This saves 50% in time and labor—cuts fastening weight 60-90%—reduces space, while providing vibration-proof security.

Self-Locking PALNUTS are single thread, spring tempered steel locknuts, easily, speedily applied with hand or power drivers. They are very low in cost, light in weight, require only 3 bolt threads space.

Self-Locking PALNUTS are available in many types for various applications, in a wide range of standard sizes. Send details of your assembly for test samples and data. Write for Palnut Manual No. 2 showing principle, advantages, application, sizes, etc.

THE PALNUT CO., 68 Cordier St., Irvington 11, N. J.



PARTS · COSTS!

Fastening Radiator and Trunk

Medallions - Globe Compart-

ment Door - Instrument Clus-

ter-License Bracket-Mould-

ing Strips - Engine Coil

Mounting—Choke and Throttle Dash Mountings — Instru-

ment Assembly, etc., etc.



Now Available ... STERLING SPEED-BLOC



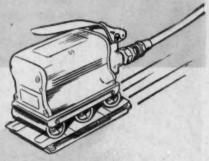
Sterling Speed-Bloc Sander is ideal for dry and wet sanding. Air driven, it is absolutely safe to use with volatile liquids.



Eliminate tedious hand sanding! Use the Sterling Speed-Bloc for sanding, lapping or polishing!



Now you can get high-speed production sanding at low cost! The Starling Speed-Bloc Air Driven Sander produces a smooth, uniform surface in less than 1/3 the time required by hand sanding. The Speed-Bloc is available for prompt delivery . . . now is the time to benefit from its time and money-saving advantages!





The Speed-Bloc is simple to operate—hand merely guides the machine. Sanding pad oscillates at a high speed with a 5%" stroke, making over 3000 back-and-forth strokes per minute. Over 19,000 Sterling Speed-Bloc Sanders now used by auto shops, aircraft plants, furniture manufacturers and a host of other industries. Ask your local distributor for a free demonstration or write!

STERLING TOOL PRODUCTS COMPANY

385 East Ohio Street

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Chicago 11, Illinois

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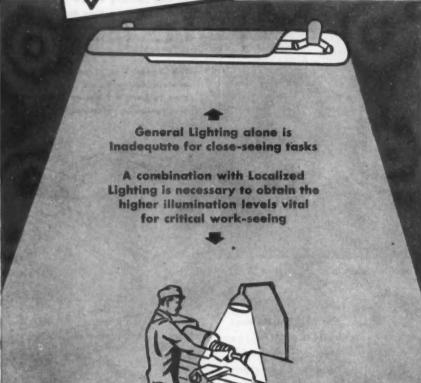
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WITH "Balanced" Lighting

Increased Production Better Work Zuality Improved Morale



FOR EXAMPLE — Quick, accurate seeing on a machining operation requires a minimum of 150 f.c. on the critical work-area, balanced with 30 mum of 150 i.e. on the critical work-area, balanced with 30 i.e. for the surrounding area—a ratio of 5 to 1. The combination of general lighting of 30 i.e. at work level and localized lighting of 150 i.e. directly on the critical work-area provides the areas of specimens. localized lighting of 130 LC, directly on the critical works area provides the proper efficiency of seeing conditions most economically.

For a fundamental survey of light for "seeing" in your plant. call Fostoria Industrial Service. A study and recommendation by these qualified specialists will offer profitable solution to your lighting problem. There is no obligation for

this expert counsel.



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Factory and General Offices . Fostoria, Ohio

Affiliated Manufacturers—Southern Industries, Inc., Atlanta Newmac Co., Ltd., San Francisco Amalgamated Electric Corp., Ltd., Toronto, Canada

New Products for Aircraft

(Continued from page 108)

strength. Structural as well as nonstructural applications for the new material are now in the experimental stage.

Glenn L. Martin composite plastic is procurable in specific gravities ranging from that of spruce and poplar wood to that of laminated phenolic plate which is about half the weight of aluminum. In addition to impregnated paper, materials successfully employed for the face plies include aluminum alloy, phenolic sheet, fibreglas and fabric among others.

Tenite Sleeves for Fluorescent Lamps



Dyed by a special process, the tubes filter black light which activates fluorescent-treated dials and knobs on airplane instrument boards. The plastic filter and lamp combination costs a fraction of present sources of black light as produced with mercury vapor or carbon are lamps. Furthermore, the Tenite filter requires no transformer or similar quires no transformer or similar accessories and does not generate intense heat. The sleeves are extruded by Extruded Plastics, Inc., Norwalk, Conn.; Tenite is a product of Tennessee Eastman Corp., Kingsport, Tenn.

Dzus Fastener Installation Tool

The Topflight Tool Co., Towson, Md., presents a tool for the installation of Dzus fasteners. When placed in squeezer the tool automatically produces a flat panel with the fastener head flush with the skin surface. Since each dimple is made by the surface of the fastener to be used in it there is said to be a perfect fit. This method requires a grommet for the installation and utilizes the angular head of the "F" type Dzus fastener to form its own



AINTED BY DWIGHT MUTCHLER

A CLOCK STARTED A REVOLUTION

Much more than a timepiece was set into motion in 1657 when Christian Huyghens applied Galileo's pendulum to a clock. This practical application of a scientific principle made possible precise, accurate measurement of time. It laid the ground-work for feats of navigation that revolutionized commerce; led to split-second timing so essential in today's machines and processes.

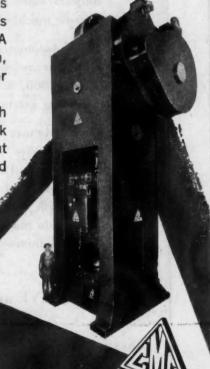
In modern industry, making a working proposition of the results of scientific research still brings about revolutionary changes. Take for example the way Clearing builds presses. The unhampered thinking of

Clearing engineers and designers has time and again produced machines that do the seemingly impossible. A Clearing press answers the question, "How can it be done best?" rather than "How is it being done?"

When you seek accurate, high speed production with presses, look to Clearing for machines to carry out your ideas for the future. You'll find here the skill, imagination and production experience and facilities that can make your ideas pay.

CLEARING MACHINE CORPORATION, 6499

West 65th Street,
Chicago 38, Illinois.



CLEARING



Continuous injection molding and extruding machine developed by Chrysler engineers

AUTOMOTIVE and AVIATION INDUSTRIES Reaches 2 Important Fields

Automotive and Aviation Industries is the industrial authority in the automotive and aviation manufacturing fields.

The leading authority on the internal combustion engine since 1895, it has consistently increased its editorial treatment of aviation subjects since the beginnings of the heavier-than-air machines.

Today Automotive and Aviation Industries, with a regular twice-a-month readership of more than 40,000, has in excess of 4,000 readers in leading aviation plants.

More and more men in aviation are subscribing to Automotive and Aviation Industries every day. More and more manufacturers are advertising to them through this leading publication. Thus, both the automotive and aviation industrial fields may now be reached through this single medium—and at a single advertising cost.

AUTOMOTIVE and AVIATION INDUSTRIES

A CHILTON Publication

Chestnut & 56th Sts.



Philadelphia 39, Pa.

Rubber and Plastic Parts Made at Fast Rate

THIS continuous injection molding and extruding machine, in operation at the Monroe Auto Equipment Co., is in production on synthetic rubber link bushings for shock absorbers under a machine license issued by Chrysler Corp. Walter P. Cousino, Chrysler project engineer and inventor of the original machine, is shown at left in photo removing rubber links from the die. while a machine operator is shown feeding a link of rubber into the injection head. Free of flash, or waste material, the mat of 144 rubber bearings was produced in three minutes. The machine has produced as large an item as a plastic battery case in less than five minutes, using eight pounds of thermosetting plastics. Tubing can be made in any desired length.

The machine, which employs a worm screw similar to those found in coal furnace stokers, has undergone extensive experiments and has shown that it can step up the wartime manufacture of many thermoplastics and thermosetting plastics, and natural and synthetic rubber articles at least tenfold.

The continuous injector consists of a hopper holding plastics or rubber. The materials are fed to a heating cylinder where a special churning apparatus keeps them evenly mixed. The putty-like substances are then shot under screw pressures up to 22,000 psi through a nozzle clamped to an opening where the die plates join. When the materials have filled the mold, or series of molds, the backpressure automatically shuts off the feeder.

Because of the uniform feed, and even mixture of materials, the curing time required by this new machine, as compared to similar materials and other types of machines, has been cut by approximately 93 per cent, besides the complete elimination of waste. The die clamping capacity of the machine has already been tested at 450 tons; the screw feed will fill any mold held at any pressures beyond that figure. When the machine automatically shuts off the flow of plastics or rubbers the worm screw reverses itself, keeping the materials remaining in the heating and feeding chambers pliable and ready for the next injection.

New Method of Surface Inspection

Faxfilm is a new method of surface inspection and comparison. By the use of a solvent, one surface of a plastic film is softened enough to permit the making of a contact replica of any surface. This small piece of film is mounted in a cardboard frame which fits any standard projector where it can be enlarged 100 diameters or more and shows all contours in three dimensions. The film can be filed for future record, if desired. Faxfilm is made by R. D. McDill, Cleveland, Ohio.



Machining cylinder barrels for RANGER AIRCRAFT ENGINES

Lodge and Shipley's Duomatic Lathes continually demonstrate remarkable versatility in meeting

the special or standard problems of the aircraft industry. For example, in machining the revolutionary cylinder barrel used in Ranger aircraft engines.

This new aircraft engine cylinder barrel, developed in Fairchild's Ranger laboratories, permits an important increase in air-cooled engine horse-power. With Fairchild's unique "Al-Fin" process, the steel cylinder core is chemically bonded with an aluminum "Al-Fin" muff, permitting faster engine cooling. To machine these new cylinder barrels with the required speed and precision, Lodge & Shipley Duomatics were selected.

The Duomatic is a full automatic lathe, with dual tool slides which can be operated singly or together. (See photo at left.) This permits more advantageous use of multiple tools—front and rear—in turning, and in straight and angular facing operations. For better, more profitable performance, call on Lodge and Shipley Engineers, or write on your company's letterhead for Bulletin 601 FL.



CINCINNATI 25, OHIO, U.S.A.

ENGINE . AUTOMATIC . TOOL ROOM . OIL COUNTRY LATHES

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New Production Equipment

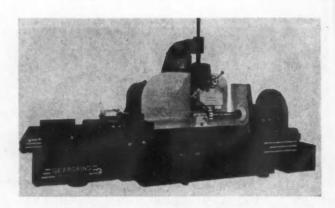
(Continued from page 80)

to 400 indexes. It may be adjusted at

any point in the cycle.

The travel of the grinding wheel carriage to wheel trimming position is automatic. This automatic travel can be made after any predetermined number of cycles (complete revolution of the work) or it may operate as a toothto-tooth index. In case of index failure an electrically interlocked safety circuit stops all movement of the grinding wheel carriage.

Geargrind formed wheel grinding machine

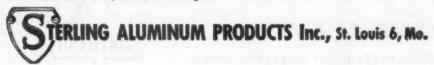




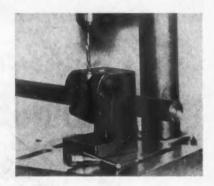
PERMANENT MOLD ALUMINUM CASTINGS CAN BE INTRICATE YET SATISFACTORY Let STERLING Engineers Show You How

Many years of designing permanent molds for aluminum castings have made Sterling engineers specialists in this type of work. Designs you may have thought too intricate to cast will be welcomed by Sterling engineers. You may get a solution that will lower your cost and improve the quality of your product.

Why not submit your specifications for today's production or postwar designs.



A WORK holding vise, the "Center Drill and Mill Vise," as manufactured by the Universal Engineering Company of San Diego, Cal., embodies several novel features, including the accurate cross-center drilling of round stock. No moving parts are involved in this operation which is said to guarantee permanent accuracy. The bushings through which the drill passes are



Center Drill and Mill Vise

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Three or more indicators are employed to check the straightness of the shaft at vital points. These indicators are attached to one pivot shaft and are all swung into position and out of position with one movement of the hand. The ram is of the traveling type and rolls along on four pre-lubricated ball bearings. The hydraulic gauge is mounted directly on the ram. The capacity of this press is 20 tons and its total length is 65 in.

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before and after

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shafts...plants that make them use cutting fluids—most often good cutting fluids. Often, however, one cutting fluid is expected to fit every job. Usually it won't, for when the operation—speed, feed, tools or stock are changed a new set of conditions exist. That means the cutting fluid factor must be considered carefully on every job—and the right fluid determined for it. Such consideration pays well.

The stainless steel parts illustrated above are a good example. It is obvious from these unretouched illustrations that the piece on the right has the better finish on both face and thread. This improvement over the left hand piece was due solely to a change in cutting oil to the right oil for the job. And this right oil proved to cost 14c per gal. less, on the machine. In this case a simple blend of Stuart's Thred Kut 99 was the answer—but it might have been any other of several Stuart Products.

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Trends in Aircraft Engines

(Continued from page 25)

pect to have engines of 8000 hp with a slightly higher specific weight than that prevailing today for military aircraft. He then asserted that the smallest number of cylinders providing satisfactory balance, in conjunction with correct firing order and smooth running, always makes the lightest engine and is the most generally acceptable for normal use. Basing his predictions on a maximum of about 200 hp per cylinder, Fedden next attempted to assess the potential power output and prospects of various practicable types of reciprocating engines as at present conceived. His views on these aspects were expressed as follows:

V-12 ENGINE — The Rolls Royce Griffon represents about the peak size for a 12-cylinder engine, but appreciable advances in power output can be expected by the use of high octane fuel. At least 2400 hp should be expected from this type of engine within the next few years.

V-16—For certain installations there would be advantages in maintaining the small frontal area of the "V"-type engine with 16 cylinders instead of 12. To develop a normal crankshaft system for a high output engine of this type is difficult, but this can be overcome by taking the propeller shaft drive from the center of the engine.

X-24 TYPE—The X-24 layout has been constructed in prototype form during the past 25 years. The latest example is the Rolls Royce Vulture of about 2000 hp. Many engineers believe, however, that the difficulties of coupling the 24 connecting rods to a single crankshaft outweigh the apparent advantages of a reduction in weight, and it may well be that a twin crankshaft arrangement would be more satisfactory for advanced engines of this type. The single crankshaft layout, nevertheless, is a possible solution for in-line, air-cooled and liquid-cooled types up to 3000-3500 hp.

X-24 TWIN CRANK — Proposals have been made for a twin crank "X" engine. By building two "V" engines into a common crankcase it would be possible to achieve an engine with little more frontal area than a single crankshaft "X" engine, with less development difficulties. But this type has no advantages over the "H" twin crankshaft layout for liquid cooling, although it might have some advantages for air-cooling.

W-24 TWIN CRANK—Another line of attack on the same problem, and one which has already been worked on in America, is to build two existing V-12s into a common crankcase with geared crankshafts. Many of the existing parts of the 12-cylinder engine can be utilized. Although this may not



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be the most compact way of gaining the desired power, the advantages of quick development make it worth consideration. If such a plan be followed using a double Rolls Royce Griffon engine, for instance, it should be possible to develop a 4000 hp engine. But the H-24 twin crankshaft engine makes a more compact and better solution.

H-24 TWIN CRANK-The Napier Sabre of 2200 hp has already proved that the "H" type engine is a classic liquid-cooled type and it is suggested that we can look forward to ultimate power outputs up to 600 hp. The "H" engine could have 28 or 32 cylinders. but the crankshaft problems of the 32cylinder version would be considerable, although the 28, it is submitted, is worthy of consideration, if the power demanded should exceed existing cylinder possibilities.

TWO-ROW RADIAL-At the present moment the 14-cylinder type is in the largest production, with power outputs around 1700 hp, but the 18-cylinder radial is rapidly coming into use with outputs of over 2000 hp. This type may be developed to give outputs exceeding 3000 hp.
FOUR-ROW RADIAL—The logical

successor to the 18-cylinder two-row radial is the 28-cylinder four-row aircooled radial, eventually of some 4000-

5000 hp. The valve-operating mechanism, however, calls for considerable ingenuity and good design, and the satisfactory disposal of the exhaust system is a momentous task, while the overhung mounting of this size requires careful consideration.

SIX-ROW RADIAL-If we attempt to establish the largest practicable type from a combination of known cylinders and known geometric layout, we come to the six-row liquid-cooled radial with seven cylinders per 10w, giving a total of 42 cylinders. Such a type, using seven Griffon cylinder blocks, could probably be made to develop over 8000 hp; but the mechanical problems and the considerable difficulties in designing a neat layout of the induction and exhaust systems might mitigate against rapid development. About 8000 hp in one unit is the limit of size of the accepted reciprocating piston engine and it will offer little competition to gas turbines above this size.

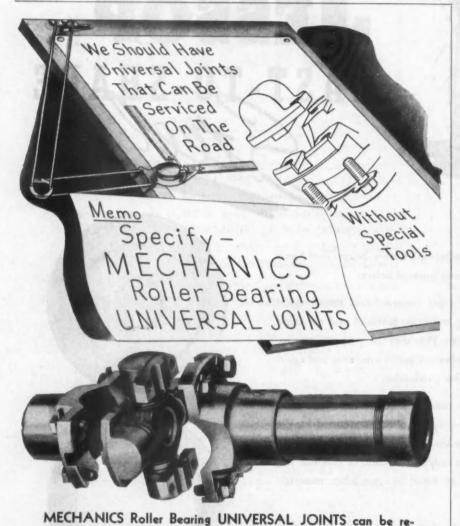
Later in his lecture Fedden had a few words to say about two-stroke-cycle en-This type, he thought, was best suited for making the most compact high-powered engine for fighters. Assuming that the potential power output of the two-stroke is limited by the intensity of the heat flow, it should still be possible to develop at least 50 per cent more power for a given size than with a four-stroke. But there are considerable difficulties in securing good fuel consumption, in view of the very

high blower power required.

Comparing air-cooled and liquidcooled engines (Fig. 2), Fedden pointed out that the weight advantage which the liquid-cooled in-line engine has gained in the last few years in bare weight is offset by the higher penalty of the cooling system as compared with the air-cooled radial. There is, in fact, very little to choose between the installed weight of high-output engines of the two types, the lower bare weight of the liquid-cooled engine being offset by the higher weight of the installation. If weight comparisons were made on the basis of unsupercharged engines the air-cooled type would show up to better advantage, for the liquid-cooled engine has beaten the other on bare weight because it is capable of using more boost. If designers of air-cooled engines had progressed faster with improved cooling, using designs having higher heat conductivity, for instance, the air-cooled engine would still be ahead in power-weight ratio as it was some six or seven vears ago. there will undoubtedly be some reduction of specific weight of new engines, this will be small, and the following figures were presented by him as a rough guide to future standards in this respect: Liquid-Air.

cooled cooled Lb. per hp Lb. per hp 1.00 Bare engine ... 1.15 Engine with cooling system Total power plant less 1.30 1.28 propellers 1.52 1.50

Dealing with the advent of the gas



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turbine, Fedden said it had been shown how well this form of prime mover could be installed and he considered that unless the installation of the reciprocating engine was taken more seriously in the future it would be more rapidly overtaken by the turbine than was often suggested.

Although the quickly detachable "standard" power plant will remain with us for some years yet, Fedden said, the reduction of drag will become so important that the engine must eventually be completely buried within the envelope of the wing, except on the smaller types of civil aircraft. In England, as well as in Germany, buried engines and shaft drives were in an ex-

perimental stage at the end of the last war. For long-range fighters and mailplanes buried engines are of great importance.

Sir Roy then referred to an illustration (Fig. 3) showing a suggested arrangement. This scheme, he said, overcomes the interference caused by three comparatively large projections on a thin, low-drag wing of about 60 ft span. There are two air-cooled radials with combined bevel drive, extension shafts and right-angled gear drives to three-blade tractor propellers.

"There is no doubt," said Fedden, "that we are about to enter, through the medium of the gas turbine, an era of ducts; and to ducted installations for

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reciprocating engines we must add lower specific fuel consumption, which in turn would entail more careful study of direct fuel injection in conjunction with the use of the exhaust turbo-supercharger."

On the subject of the gas turbine and jet propulsion, Fedden suggested that the relatively low efficiency at low speeds with jet engines might necessitate combining jet and propeller propulsion, and he produced an outline sketch (Fig. 4) showing a multi-stage, axial-flow gas turbine unit driving contra-rotating pusher propellers and having secondary propulsion from jet reaction, the proportion being probably

charging outside the propeller disk, but there will undoubtedly be many alternative methods of installing such a

of the order 70:30. The installation is shown with divided exhaust ducts dis-

power plant.

"Adequate efficiency, flexibility and stability of operation of multi-stage. axial-flow compressors and turbines will only be achieved by patient development," said Fedden. "In addition, there are many problems to be solved relating to turbine materials, blade vibration, differential expansion and so on. We must be prepared to plan our development program wisely and not be tempted to rush into production with partially developed designs. In the gas turbine we may expect to have a prime mover with altogether new standards of reliability and performance. Some outstanding advantages should be reduced drag and weight of power plant, the provision of a smooth torque characteristic, elimination of mechanical chatter and intermittent exhaust noise, and possibly the use of kerosene or some similar high flash-point fuel."

Penn Salt Organizes **Export Department**

Pennsylvania Salt Manufacturing Company announces the organization of an Export Department at the Company's main office in Philadelphia. Mr. John H. S. Barr has been appointed manager. The formation of an Export Department is a result of the company's study over the past year of the possibilities for postwar business in all Latin American countries including Cuba, Haiti, Jamaica, and Puerto Rico.

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The George Scherr Company, New York, N. Y., makes available its new Atlantic emergency set containing 36 cylindrical plug gage blanks in steps of 1/16 in. with handles as illustrated. This emergency set will permit any shop to produce any size plug gage from .29 in. to 1.000 in. on a cylindrical grinding machine. Atlantic plug gage blanks are oil hardened throughout, shank finish ground and centers on both ends are lapped. Thus, it is necessary only to grind the blanks to produce a commercial finish gage.



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War Contract Termination

(Continued from page 18)

(5) basis of compilation of costs included in claims.

The training program for subcontractors and vendors should be supplemented from time to time by instructions from contractor's field representatives at the time of checking a specific subcontractor's claim. At such time the contractor's representatives can direct the attention of his subcontractor to variations from standard procedures

or from applicable regulations and other deficiencies in the preparation of his claim, thereby preventing a repetition of similar errors in the future.

Section 17 of the Contract Settlement Act provides for the formalization of defective or informal contracts. Accordingly, contractors should review the status of their agreements with the Government to see whether there are any which need to be formalized. If

there are any, this should be done prior to termination. With respect to the matter of terminating contracts for default in connection with the curtailof procurement, recognition ment should be given to the fact that the War Department's oft-stated policy is not to terminate contracts for default when the real reason for termination is the Government's convenience. It should be pointed out, however, that under the Uniform Termination Article the Government reserves the right, even in the case of a general termination of war contracts to terminate for default where the contracting officer finds that the contractor is in gross or willful default. Accordingly, it would be very well for any contractor who is substantially in default to see if he can extricate himself from this position in order to make certain that the contracting officer concerned does not, as a result of misapprehension of the circumstances or otherwise, find him to be in gross or willful default.

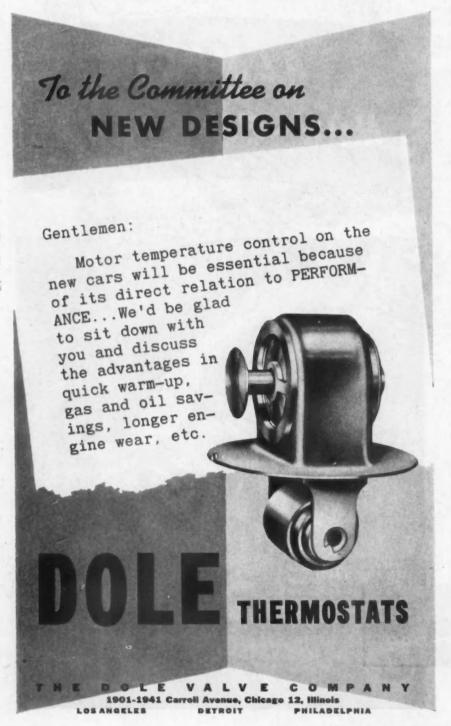
At the time of the receipt of his notice of termination, the contractor should determine at once whether the termination is one for the convenience of the Government or of the customer. A termination for the convenience of the customer, of course, is of no concern to the Government and must be handled in accordance with customary

commercial practice.

Termination inventories should be physically segregated in separate warehouses or storerooms, carefully identified and maintained under the control of a representative of the contract termination supervisor, so that no removals of such stocks can be effected without a proper requisition by means of which the necessary credit may be made to the claim. This will eliminate difficulties when the inventories are inspected and reviewed by representatives of the Government. Where space permits, locations for the storage of termination inventories should be arranged for now.

Therefore, any contractor who desires to simplify his termination problem should endeavor to decide immediately just what he is going to do with the materials of various types. He should decide whether he intends to make a demand on the Government for their removal pursuant to Section 12 of the Contract Settlement Act, whether he is going to enter into a storage agreement, or whether he is going to follow some other course. Prime contractors in particular should review this problem with the procurement agency having cognizance over their contracts so that when the time arrives for taking action they will know what they are going to do. Contractors who desire to exercise their rights under Section 12 of the Contract Settlement Act with respect to the removal and storage of materials should make a careful examination of those Sections

(Turn to page 208, please)



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PROPELLER

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This stud is chrome-molybdenum steel 32-36 Rockwell C. The threaded section, 11/16" long (7a"—20NF-3), is plunge ground in one-third the time required by conventional grinding.

SLEEVE



This steere is SAE-1015 used 25-30 Rockwell C. The stranded section, 15" long (13" "-16N-3), is plunge ground in con-quarter the time required by grinding with a strang party wheel.

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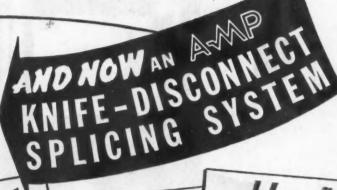
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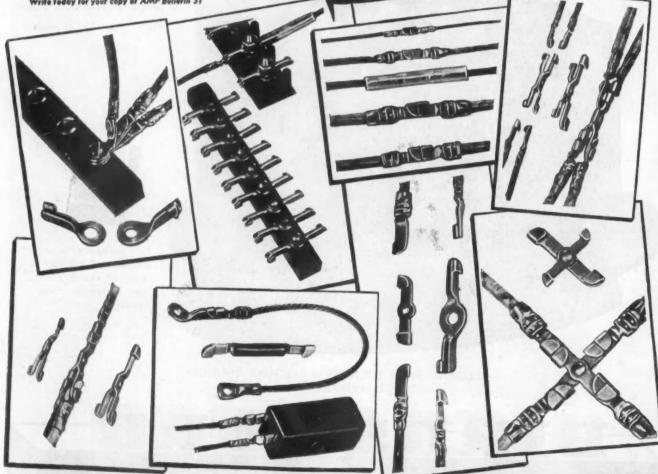
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Bronze	Poor	Poor	Poor	Poor	Poor	Poor
Cadmium Plate	Good	Good	Good	Good	Good	
Cast Iron	Good	Good	Good	Good	Good	Fair
Chromium Plate	Fair	Fair	Fair	Fair	Fair	Fair
Copper	Poor	Poor	Poor	Poor	Poor	Poor
Dow Metal	Good	Good	Good	Good	Good	Good
Galvanized Iron	Poor	Poor	Poor	Fair	Good	511255555
Lead	Good	Good	Good	Good	Good	Good
Stainless Steel	Fair	Fair	Fair	Fair	Fair	Fair
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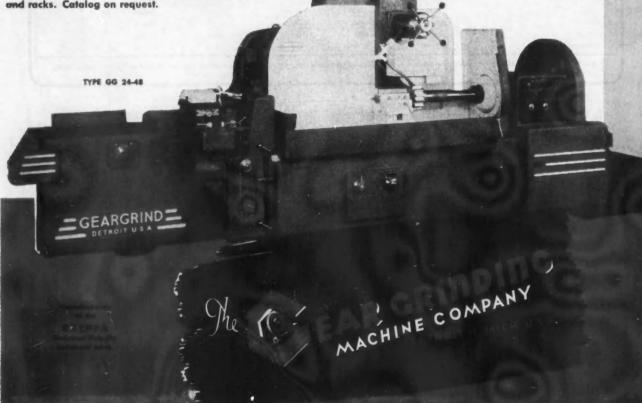
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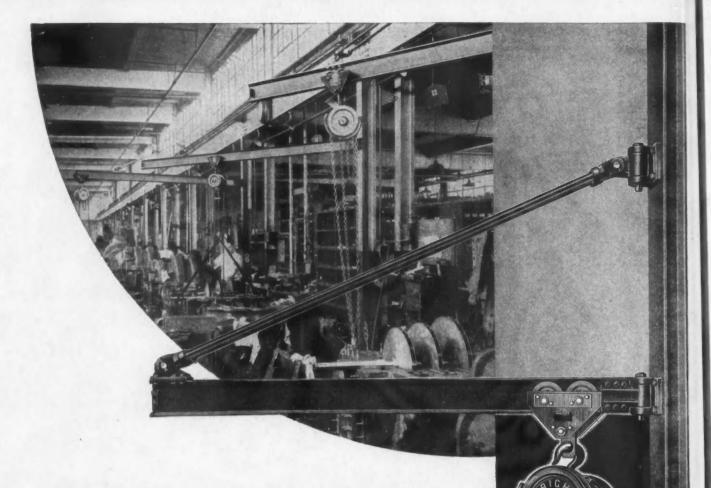
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WRIGHT'S WALL BRACKET JIB CRANE, used in conjunction with either the WRIGHT HAND-OPERATED CHAIN HOIST or the WRIGHT ELECTRIC HOIST, is the right combination for more efficient production. This combination is extremely desirable for supplementary use to the overhead traveling crane or monorail track, or for individual use on the side of shops, or in bays as illustrated.

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ALUMINUM'S "PORT OF EMBARKATION"—outside Reynolds' great plant at Listerhill, Ala., millions of pounds of aluminum ingots await their swift transformation into sheets for airplane wings, foil to protect supplies, hundreds of other uses. Reynolds has rolled more light-gauge aluminum than any other company.

REYNOLDS ALUMINUM:

A shortage turns into abundance...and America gets more efficient weapons

When snarling Axis planes swarmed over Europe's sky, they thundered out the inescapable fact that this was to be a war of light metals—of aluminum.

At that time, Germany was making three times as much aluminum as the United States.

This was a plain warning of peril to America. Heeding it, Reynolds Aluminum went into action. On its own resources, Reynolds set up huge new aluminum plants . . . started the long fight to end a shortage of aluminum that could be disastrous for this country.

Today, the success of this struggle is apparent in one great fact of American aluminum production...output is now more than enough to fulfill minimum war needs—that is, aluminum for our growing thousands of warplanes.

The hard-won abundance of this vital metal means that aluminum can now be applied to dozens of uses where lightness plus strength will mean a

more efficient weapon for airfield

landing mats; gun mounts; cartridge cases; hundreds of other war uses.

"THE FUTURE THAT COUNTS MOST"

Reynolds has its plans, and its definite program for peacetime application of aluminum's magic to hundreds of new uses; but the men of Reynolds have taken to heart the words of Robert P. Patterson, Under Secretary of War..."The future that counts most," said Mr. Patterson recently, "is that stretch of time between this day and that day on which the last shot of this war will be fired.

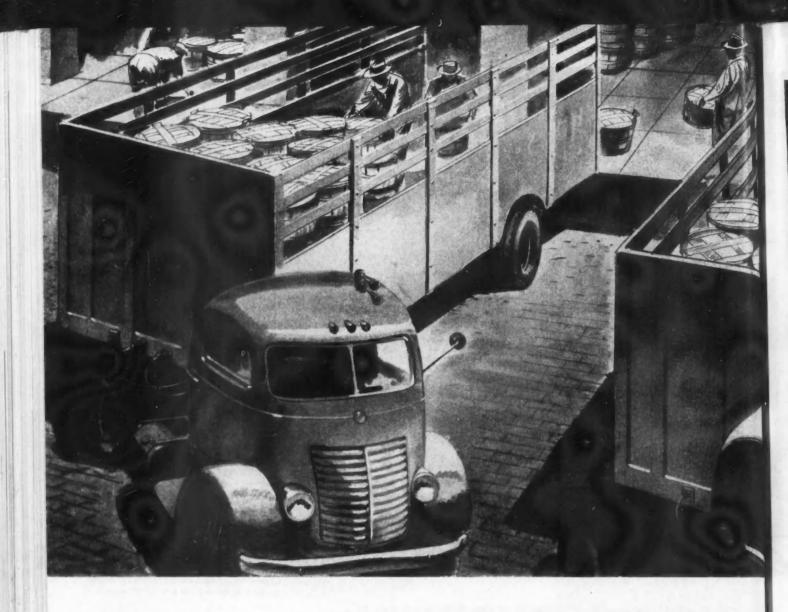
"Aluminum, alone of the three controlled materials, is meeting production schedules on military requirements; but for any of us to interpret this as a signal to take it easy is an error. Our opportunities to serve our fighting men can be as inexhaustible as is our debt to them for what they do."

Reynolds intends to meet this challenge to produce, in its 40 plants, for "the future that counts most."



WEAPON OF AIRBORNE INVASION... airfield landing mats, potent weapons of attack, are now made of tough aluminum alloys, strong enough to withstand the jounce of giant bombers.

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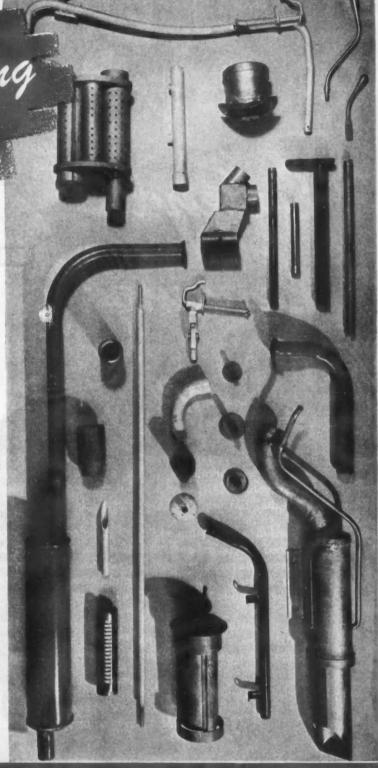
This picture shows only a few of many different kinds of metal tubing and stamping assemblies—fabricated by Noblitt-Sparks—to go into the products of other manufacturers. But this may suggest something that our company might make for your company—now or later—to your advantage as well as ours.

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COLLABORATION BETWEEN MANUFACTURER AND USER PRODUCES MACHINE WHICH MORE THAN DOUBLES PRODUCTION



● Here is an interesting example of how a large motor manufacturer collaborated with our engineers in designing and building special machine tools to suit their job. As a result, cylinder block drilling was increased from 720 blocks per month to 2,000 blocks per month. In addition to increasing production, one Barnes machine with one operator replaced six single spindle drilling machines.

This manufacturer uses three Barnes machines in his production line. Drilling and tapping heads on these machines are of his own design. One machine drills holes on both water side and valve side simultaneously. The second machine is used to tap all holes on both sides of the block, except the angular holes. The third machine taps all holes on top and bottom of block. Roll conveyors and small power hoists are used to handle the blocks from one machine to the other.

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For Velon, Firestone's new wonder fabric, opens a whole new world of color in car upholstery. The lightest, gayest of tints. The richest of deep tones in any effect, from quiet dignity, to brilliant gem-like sparkle. In an infinite variety of

All in a material more practical than ever used for car interiors before! Velon never fades. Noninflammable, stainless. Resists grease, acids, alkalis, solvents.

It can always be wiped fresh as new with a

damp cloth. Velon's original colorful beauty is virtually everlasting!

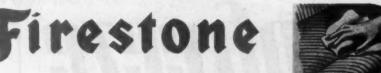
And so, apparently, is Velon itself. Test installations of Velon in public vehicles overburdened with wartime traffic show NO signs of wear after three years!

Never before such beauty for upholstery and interior decoration. Never before such durability! Change or no change in exterior lines, first postwar models can have new, almost revolutionary sales appeal-with Interior of Velon!

P.S. For completely modern seating make the cushioning Foamex, Firestone's foamed latex.









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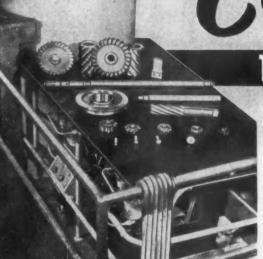
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Cold Treating



HARDENING OF TOOL STEEL

A few tools and machine parts cold treated in one plant are shown on the table of the Deepfreeze Cascade -120° F. Industrial Sub-Zero Chilling Machine.

Here's How Others Are Getting the Advantages of

Deepfreeze Sub-Zero Temperatures

• Deepfreeze Industrial Sub-Zero Chilling Machines are being used daily to harden cutting tools, stabilize gauges, shrink many steel parts for assemblies of various types, and to cold test aviation instruments and parts. For instance, tool life of high-speed drills, used to drill 4 holes in a yoke lever part, was increased over 500% by cold treating in the shop of one large machine tool manufacturer.

Equally remarkable results were obtained by using Deepfreeze subzero temperatures to stabilize gauge blocks and lapping flats, with the result of increasing their life 2000%. Another manufacturer uses a Deepfreeze Industrial Chilling Machine with automatic feed to shrink valve insert seats for engine blocks with a saving of \$3,675 per year over the cost of dry ice. These are but a few of the many applications manufac-

turers are finding for Deepfreeze Sub-Zero Temperatures.

How to Determine What Benefits You Can Get From Cold Treating

To determine the exact benefits that your company can derive from applying cold treating to your production, consult the Deepfreeze Engineering Service, which is conducted expressly for this purpose. Your inquiry will not obligate you in any way.

Free... New Cold Treating Textbook

A new 40-page booklet containing complete up-to-date information on cold



plete up-to-date information on cold treating and including new procedures, applications, performance data stories, etc., has just been published and will be sent to you upon request. Write for Bulletin No. 1-4.

2 SHRINKING OF METALS

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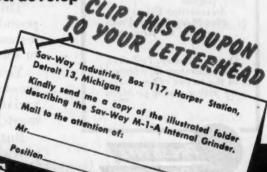
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This Sav-Way multi-purpose internal grinder has 17 specific features—the features which you production men have asked for. Neoprene insulated against vibration, distortion, mis-alignment. Equipped with the famous Gold Seal Spindle—the spindle that breathes! Combines accuracy and staming with the speed, flexibility, and wide range adaptability so necoming period of change-over and new product develop-CLIP THIS COUPON





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"Heli-Coil" Inserts are precision-shaped helical coils of stainless steel or phosphor bronze wire. They engage tapped threads of the American National System, protecting them against abrasion, stripping and seizing.

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You'll find Cone-Drives in many everyday products when the war is over. In the meantime, if you don't know the "why and how" of Cone-Drives, we will be glad to tell you about them.



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CW-41B (for Executives) • CW-41A (for Design Engineers)

CONE-DRIVE DIVISION MICHIGAN TOOL COMPANY 7171 E. McNichols Rd., Detroit 12, U.S.A.



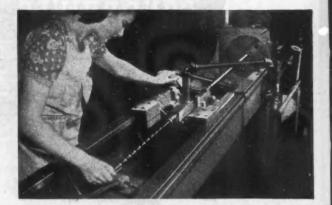
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Scrap was reduced 97% when gun barrel rifling was changed over to broaching.



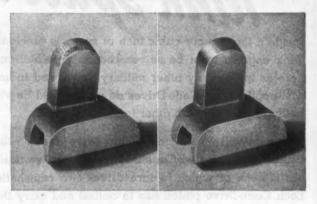
GREATER SPEED

Switching this hydraulic cylinder from boring to broaching cut production time $48\frac{1}{2}$ minutes on one operation alone.



FINER FINISH

The radius on the end of the tongue had been formed by a shaving die. Changing to broaching improved finish and accuracy and entirely eliminated breaking out of the tip under die pressure.



The modern manufacturer cannot afford to overlook the possibilities of broaching. It will cost you nothing to find out how broaching can improve production in your plant. Get in touch with the nearest Detroit Broach representative or with either plant and a competent engineer will be glad to give you complete cost and production data without obligation.



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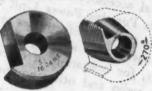




Namco Micrometer Gauge is also used for Multiple Circular Hollow Milling Cutters. These cutters are interchangeable with Circular Thread Chasers in the same Self-opening Diehead.

This Micrometer Grinding Gauge determines the proper amount of grind for Namco Circular Chasers, and then checks the accuracy of the Chasers after the grind.

Long runs of Class 3 threads start with precision—and precision is maintained throughout the run, because Chasers are reground on blocks that support them, and returned to head to cut identical threads without adjustments or variation.



Namco Self-opening Dies with Circular Ground Thread Chasers Cut Production Costs because

- ... Chasers may be ground through 270° circumference
- ... they maintain accuracy throughout the run
- . . . reground Chasers may be replaced in two minutes, without disturbing the setup
- ... they eliminate "experimental" cuts—no spoiled work to increase costs
- ... grinding off as little as .008" per grind increases Chaser life 20 to 50 times

New Catalog D-42B gives you complete details.

THE NATIONAL AGMES CO.

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ACME GRIDLEY 4-6 AND 8 SPINDLE BAR AND CHUCKING AUTOMATICS • SINGLE SPINDLE AUTOMATICS • AUTOMATIC THREADING DIES AND TAPS • THE CHRONOLOG • LIMIT AND CONTROL STATION SWITCHES • SOLENOIDS • CENTRIFUGES • CONTRACT MANUFACTURING





Supplying tools to America's aircraft industries and to the armed services for the maintenance of our war planes is one of Duro's important war jobs. In this assignment, as in those of supplying tools to the Armed Forces, War Industry and Automotive Industry, Duro-Chrome Tools are living up to their quarter century reputation for being "Doggone Good Tools". Back of this reputation are

Duro's exacting standards for quality . . . our complete facilities for the manufacture of tools from molten metal to the finished product . . . our billion tool manufacturing experience . . . and our continuous engineering attention, over the years, to design improvement.

Duro Metal Products Company, 2649 N. Kildare Avenue, Chicago 39, Illinois.



ALSO MAKERS OF DURO MACHINE TOOLS



Send for the New REAM-MOR blade bulletin for complete details.

WETMORE REAMER CO.

421 North 27th Street, Milwaukee 8, Wis.



Several important types of Whiz Hydraulic Fluids are manufactured by R. M. Hollingshead Corporation, a major supplier for Army and Navy Aircraft.

Of these fluids, two types are currently in great demand. Both conform fully to Government specifications. Each is supplied in two grades.

TYPE AND GRADES

WHIZ CASTOR OIL BASE TYPE Grade C—Light Grade A—Heavy

INDICATED USES

Used primarily in hydraulic braking systems, shock absorbers, strut shocks, retractable landing gears. Other mechanisms where specified.

CHARACTERISTICS

Non-gumming; provides maximum lubrication and correct viscosity. Maintains stable fluidity. Grade C for sub-zero temperatures. Grade A for warmer climates.

WHIZ PETROLEUM BASE TYPE Grade L-Light Grade M-Medium

For use in automatic pilots. Other mechanisms where specified.

Non-gumming. Non-corrosive-will not dam-Mon-gumming. Non-corrosive—will not damage metal, synthetic or natural rubber parts. Maintains stable fluidity. Grade L for temperatures down to -60°F.: will not thicken, congeal, or freeze. Grade M designed for use at temperatures of -50°F. and higher.

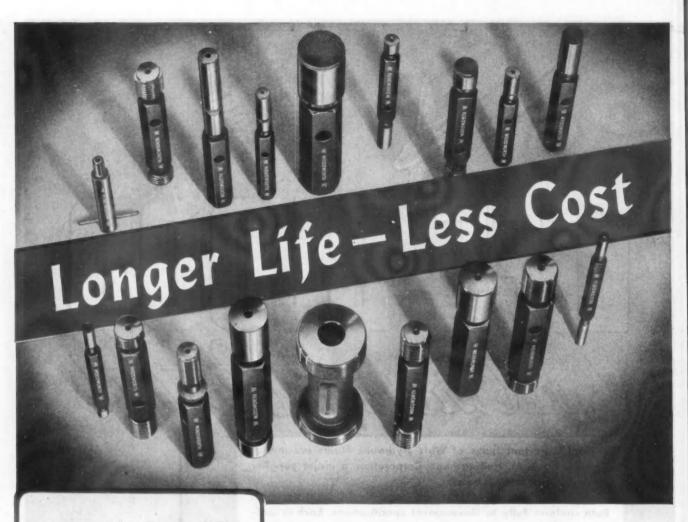
Your inquiries about these hydraulic fluids will receive prompt attention. Our engineers will gladly work directly with your engineers in designing special chemical products to meet unusual requirements. R. M. Hollingshead Corp., Aviation Products Division, Camden, N. J.; Toronto, Canada.

BUY MORE BONDS!

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ALSO MAKERS OF WHIZ RUST PREVENTIVE COMPOUNDS, COMPOUNDED LUBRI-CANTS, LUBRICATING OILS, AND CLEANING COMPOUNDS FOR AIRCRAFT







The new LIMITROL comparator gage reduces inspection time to one-fourth that of other methods.

other methods.

The LIMITROL checks pitch diameter, lead, taper, angle, out-of-roundness and straightness. It eliminates "feel" and reduces scrap. Write for circular No. 44-L.

STELLITE cast alloy, a new development of Weedworth and Stel-lite engineers.

Stellife cast alloy gages are non-corrodible and non-magnetic . . have a low co-efficient of friction, low affinity for other materials and a low co-efficient of expansion close to steel. Write for circular No. 44-5. Stellite cast alloy



The N. A. Woodworth Company's objective in the industrial world is to produce the most accurate tools with the longest possible service life at the most reasonable cost.

Woodworth engineers are constantly searching for new ways and means to increase production speed and reduce production costs. An outstanding example of Woodworth's ability was the development of Stellite Cast Alloy Gages which outwear steel 15 to 1.

The N. A. Woodworth Company will continue to give industry today and tomorrow "firsts" in gaging that will increase production and reduce costs.

ACCURACY YOU W CAN TRUST



VOODWOR

N. A. WOODWORTH CO., SALES DIVISION, 1300 E. NINE MILE ROAD . DETROIT 20, MICHIGAN

PRECISION GAGES PRECISION MACHINED PARTS

PLATING

'THE STANDARD HOSE FITTING'

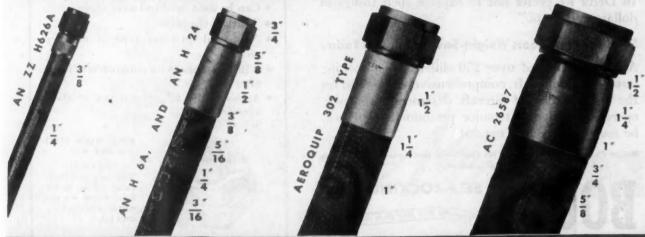
3 PIECES (EACH REPLACEABLE)

ASSEMBLY WITHOUT SPECIAL TOOLS. NO TIGHTENING OR ADJUSTMENT AFTER ASSEMBLY. FITTINGS CAN BE REMOVED FROM HOSE AND RE-USED OVER 100 TIMES.

AEROQUIP CORPORATION

JACKSON, MICHIGAN, U.S. A.

LOW PRESSURE . MEDIUM PRESSURE . MEDIUM HIGH PRESSURE . BULLET SEALING HOSE LINES



303 WAREHAM BLDG., HAGERSTOWN, MD.—1709 W. 8TH, LOS ANGELES—PRENCO—72 STAFFORD ST., TORONTO, ONT. PERMANENT LICENSEE: WAGNER ELECTRIC CORPORATION, 6400 PLYMOUTH AVENUE, ST. LOUIS 14, MISSOURI

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"Every Pound Saved on a Delta Airliner Has a High Monetary Value"



OPERATIONS MANAGER
DELTA AIR LINES

"The value of a pound of pay load during the life of an airliner has been variously estimated. The exact value will, of course, vary with the degree of utilization of the equipment.

"Certainly, during this period of capacity loads, every pound which can be saved has a high monetary value, and will at times be priceless.

"A few pounds saved may mean that another soldier gets home for his last leave, that another war-valuable shipment of express gets through on time, or that another sack of mail can go aboard. In Delta we prefer not to express such things in dollars and cents."

Send for Free Boots Weight-Saving Booklet Today

Actual weights of over 250 different self-locking nuts used in aircraft, comprehensively reviewed for the convenience of aircraft designers, engineers, operating and maintenance personnel. Copy will be sent you, free, on request.

Metion Picture—"All Work And No Play"—16 mm. sound—30 minutes
Write for information

BOOTS

SELF-LOCKING NUTS



Boots Aircraft Nut Corporation, General Offices, New Canaan, Conn., Dept. H



BOOTS NUTS SAVE UP TO 60 LBS. PER PLANE

- Being all metal, they are TOUGHER and SAFER as well as LIGHTER.
- Can be used over and over again.
- "Outlast the plane."
- Now used on every type of military aircraft.
- Will be standard on commercial planes after Victory.
- Approved by all government aviation agencies.



BOOTS WING-STYLE
HEX NUT
(W65.8-32)
The comparable fibercollar nut is 96.4%
heavier than this allmetal self-locking
steel nut.

Representatives in New York • Chicago • Detroit • Indianapolis • Los Angeles • Kansas City • Dallas • Toronto • Montreal • Yancouver





Out of the Nation's War Plants Comes

OAKITE

CRYSCOAT

TRADE MARK REG. U. S. PAT. OFF.

PROCESS

A low-cost chemical conditioning treatment for steel and iron surfaces and fabricated work that inhibits rust and solves the problem of paint adhesion

This new, scientifically engineered Oakite development, now successfully used on many different types of war materiél, can be employed on a wide variety of peacetime products to which paint and similar organic finishes are applied and where surface protection is a prime factor.

Performs THREE Functions In ONE Operation!

Performing THREE distinct functions in ONE time-saving operation, Oakite CrysCoat No. 86, an integral part of the Oakite CrysCoat Process, marks an important advance in the surface preparation and conditioning of ferrous metals before painting. Used in automatic pressure spray machines or by tank immersion method, Oakite CrysCoat No. 86:

- Removes light oils, grease, drawing lubricants, shop dirt
- 2 Imparts a microscopic protective crystalline coating that inhibits surfaces against rust
- Provides surface grippage that assures firm, TENACIOUS ADHESION of paint or other organic finish

Free Special Service Report Gives You Details!

A FREE 3-page Service Report gives you operating details, describes methods of application and the many advantages resulting from the use of Oakite CrysCoat No. 86. Write for your copy today.

OAKITE PRODUCTS, INC., 28A Thames St., New York 6, N. Y. Technical Service Representatives Located in All Principal Cities of the United States and Conada

OAKITE
MATERIALS METHODS SERVICE



CLEANING

FOR EVERY CLEANING REQUIREMENT



The Japs have not liked the Helldiver since it first appeared in that destructive attack on their shipping at Rabaul on Armistice Day, 1943. This advanced type dive bomber has since been smashing the Japanese over a wide area. Soon known as the Navy's "Sunday punch," the Hell-diver has been adopted by the Army and Marines for ground attack. Bigger, faster and packing a heavier load of bombs—large and small—than its predecessors, the Helldiver unleashes a tornado of machine gun bullets over enemy ships or ground installations after dropping its

The Helldiver's wings fold upward so that two can be handled at one time on a carrier's ele-

No piece of fighting equipment is more severely strained than a dive bomber. Those pull-out stresses are worse than abusive, yet this plane has proved as staunch as it is deadly.

We rejoice in the belief that a share of the ruggedness of this outstanding plane is contributed by the super-tough drop forgings which we have furnished for the parts subjected to shocks and stresses. As the demand from many fronts for more Helldivers grows, increasing quantities of these drop forgings have been called for—and we have delivered.

Our modern plant is producing airframe drop forgings exclusively. The inquiries of plane and engine builders for drop forgings of any size and type are solicited.





PHOTO: COURTESY AMERICAN AIRLINES

"STAGE COACH"

It's a far cry from the old-fashioned stage coach to the swift, modern, streamlined airliner, but this progress typifies American imagination and initiative at workthe dreaming and the doing of men who possess abiding faith in the greatness of America's destiny.

There's a striking parallel between the modern airliner and the production achievements of Continental Die Casters. Here the "streamline era" began before the war started when traditionally indolent die casting methods were superseded by new techniques which made possible tremendous strides in production.

The urge to accomplish great results in war production has since won for Continental the leadership in die casting. Today we are looking forward to post-war opportunities because the methods and efficiency developed by our engineers on war work are applicable to peace time die casting on the production line. We invite you to consult Continental engineers on any problem which involves the use of die castings in your post-war problems.



Streamlined ASH TRAY COVER

This streamlined ash tray cover is fashioned to serve the needs of tomorrow on a sleek, modern car. It can be made finer and faster by die casting because of revolutionary new methods developed by Continental engineers. It is one of many streamlined designs which can be die cast with greatest economy and the finished product is a thing of beauty.

CONTINENTAL CORPORATION CASTING

9615 GRINNELL AVENUE

DETROIT 13, MICHIGAN



LIFTING DRY SAND IS NO FUN!

A 100 pound bag of dry sand is heavy enough. But soaked with water, it weighs 125 pounds and is that much harder to lift.

Resilient parts of a plane-gaskets, packing, seals, hose, accumulator bags, diaphragms-may also take on additional weight-by absorbing petroleum products with which they are constantly in contact! Not included in the original design, this dead weight handicaps plane performance-reduces speed-lessens pay load. Swelling of liners may decrease capacity of hose, accumulator bags, or other similar parts.

Hycar synthetic rubber licks both of these problems. Light in weight to begin with, Hycar's superb resistance to oil absorption keeps it light-provides protection against increased weight and decreased capacity offered by no other comparable material.

15% to 25% lighter than many other synthetic rubbers

Closely controlled oil swell to insure dimensional stability of parts

Operating range from -650 to +2500 F.

Abrasion resistance 50% better than natural rubber

Minimum tendency to cold flow after taking initial deformation even at elevated temperatures

All highly important qualities in aircraft applications!

You need these properties in resilient materials used in the presence of oil and gasoline. Let our Technical Service Staff help you solve your individual problems. Hycar Chemical Company, Akron 8, Ohio.

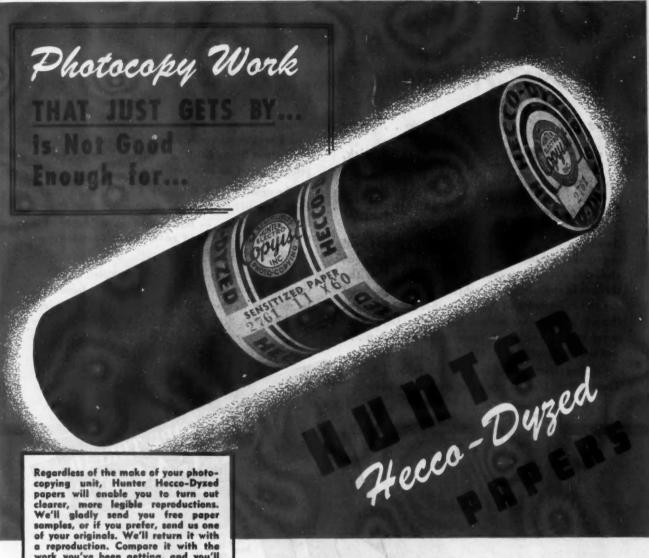


EARGEST PRIVATE PRODUCER OF BUTADIENE TYPE

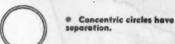
Synthetic Rubber

Correct pronunciations and meanings of commonly used synthetic rubber names and terms are given in the new pocket-size Hycar Glossary. Write for free copy.

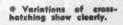




work you've been getting, and you'll agree that for quality, it has to be HUNTER.



- parallels don't
- · Fine lines reproduce.
- Heavy lines are sharp and strong.
- Ne blotching where lines intersect.





Yes, there's plenty of difference in photo-copying papers—the same difference that shows up in your reproduction work, depending on whether you use Hunter Hecco-Dyzed or ordinary paper.

Depth of black in the photocopy negative is indispensable for sharp detail when reproducing all kinds of engineering work. Without it, fine lines burn out and many lines appear fuzzy and uneven. Hunter papers have a maximum of silver, to give you plenty of depth of black. Close parallel rulings don't fill in, hair lines show up clean and firm, and intersections reproduce without diffusion.



Hunter Electro - COPYIST has pioneeered Engineering Department Photo-copying. Six sizes. Prices

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And Hunter papers have this outstanding quality, too . . . they're UNIFORM, both in time of exposure and time of development.

Ask to be shown! Call the Hunter Electro-Copyist distributor (his name is in the classified 'phone book), or send us one of your originals. We'll return it with a sample of the kind of reproduction work you should be gettingand can get dependably-if you specify Hunter Hecco-Dyzed Papers.

What you want to Know about ANPT Pipe Thread Gages

What they are . . . What they do . . . how to use them. You'll find everything in quick, complete, workable detail in this new P&W Booklet!

American war planes have demonstrated beyond question their ability to absorb heavy punishment and still fly. One reason is the excellence of the threads in the aircraft pipe fittings that carry vital gas and oil. Army and Navy specifications for these threads are necessarily rigid. They must hold tight, never leak, never shake loose under vibration . . . and without packing.

Cutting these threads is a precision job. Then every thread must be inspected individually to make sure beyond any doubt that it will assemble *correctly* either here at home or on far distant flying fields. The lives of our American pilots depend on this inspection.

The new Pratt & Whitney ANPT (Army Navy Pipe Thread) Gages provide this quick and positive inspection . . . tell almost at a glance if a thread meets the rigid government specifications or should be discarded.

It's an important subject . . . complex to understand. But we have covered it fully in a form easy to grasp in this new Pratt & Whitney booklet just off the press. Simply write on your own company letterhead for a copy of our booklet on ANPT Pipe Thread Gages and it will be mailed at once.

PRATE & WHITNEY

PIRATE & WHITNEY

Division Niles-Bement-Pond Company
WEST HARTFORD 1. CONNECTICUT, U. S. A.

STREAMLINED STRENGTH

The gear teeth in your Fuller transmission may not be shaped like the tear-drop... the root from which all streamlining stems, but in practice they are similar. In their research, Fuller engineers sought a design which would provide simplicity, strength, and resistance to wear, plus smooth, quiet gear-meshing. The resultant streamlining of the Fuller gear tooth, as radical a departure from standard practice as the streamlined train, is the reason why Fuller transmissions run quietly, shift easily and wear longer.

FULLER MANUFACTURING COMPANY, KALAMAZOO, MICHIGAN
Transmission Division

Unit Drop Forge Division, Milwaukee, Wisconsin



Used on the Martin Mars

PANELYTE Aircraft Flooring, molded of high-strength, laminated phenolic plastic, weights approximately ½ pound less per square foot than other floorings of equal strength and capacity. Developed by the Glenn L. Martin Company and installed in the Martin Mars, this new type flooring consists of a flat top surface molded to a web, which, for greater strength, may be reinforced with aluminum alloy inserts. The non-skid, morocco top finish lightens the plane by eliminating the need for floor covering. Requiring no special procedure or bracing, it is quickly installed. It is supplied in 11 grades to meet varying strength requirements.

Used on the Martin B-26

PANELYTE Heavy Duty Cargo Flooring is ideal where plane loading surfaces are subjected to abnormal stress and strain. Designed to withstand the abuse of loading and unloading tanks, machinery, etc., this shock-proof flooring is constructed of high-strength PANELYTE cured to the top and bottom of a tough plywood core. Easily fabricated by standard wood-cutting tools, PANELYTE Cargo Flooring is shipped ready for installation. The morocco top surface does away with labor and expense of providing and fitting floor covering. Rugged, yet light in weight, this flooring meets cargo service specifications.

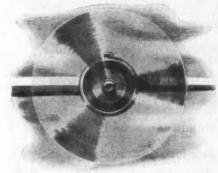
Samples and data on these light weight PANELYTE floorings furnished on request. Our Engineering Staff will be happy to assist in the design of laminated plastic parts for mass production. Write for "Data Sheets".



MASS PRODUCTION OF SHEETS, RODS, TUBES, MOLDED FORMS, FABRICATED PARTS



STEEL "PROP" BLADES THAT SWING 194,000 LBS.



At take-off speed, the centrifugal pull on each of the hollow steel blades of a 161/2-foot propeller on one of our largest and fastest aircraft is 97 tons or a total of 582,000 pounds on the 3 blades.

That's a terrific force-and an important reason why electric furnace steels are used in the manufacture of large-diameter "prop" blades. Only electric furnace steel can consistently meet the exceptionally rigid specifications, pass X-ray and other exacting tests, and provide high resistance to erosion from water spray, sand and gravel in the air.

There's another reason, too, why thousands of hollow steel "prop" blades are made of Republic Electric Furnace Steel-the steel that's always as UNIFORM and CLEAN and SOUND as the most expert furnace practice can make it.

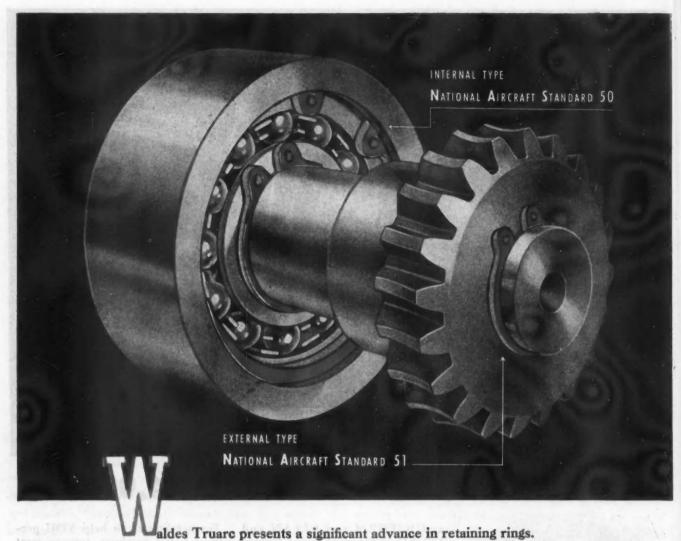
The process by which these blades are made is exacting—involves 100 separate operations. The steel must not vary or interfere with rapid flow through the various production steps. It must be consistent in physical, chemical, welding, machining and heat treating properties. It must be homogeneous-free from imperfections which could cause rejection at final inspection and loss of irreplaceable time and costly effort.

Let us tell you how Republic Electric

Furnace Steels can help YOU produce better products, too—to meet keen competition in peacetime mar-kets. When you use these fine steels, consistent uniformity predetermines costs. Freedom from practice-upsetting variables insures maximum results from mass production methods. "Targeted" quality possible only in electric furnace melting hits narrow specifications on the nose.

REPUBLIC STEEL CORPORATION Alloy Steel Division Massillon, Ohio GENERAL OFFICES . CLEVELAND 1, OHIO

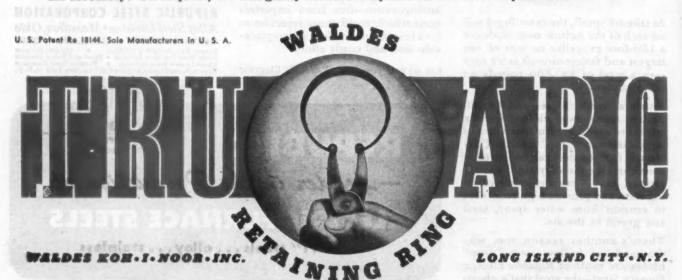




It spreads or contracts without distortion; always retaining its perfectly fitting circular contour.

For thrust-load fixing, and shaft and housing applications, Waldes Truarc provides

distinct advantages over nuts and bolts or wedges and washers . . . it reduces dimension
and weight . . . saves material . . . cuts manufacturing time . . . simplifies assembly and
dis-assembly. On request, we will gladly furnish samples and full data for your tests.



Canadian Representative: Prenco Progress and Engineering Corporation, Ltd., 72-74 Stafford St., Toronto

Now, Accurate Reflex Torquing faster than thought...



WITH THIS NEW WRENCH, accurate torquing becomes fast and automatic. When the exact "set" torque is reached, the SENSORY Mechanism sends three simultaneous nerve impulses to the operator's muscular control. Seconded through three channels—sight, sound and feeling—all three at once—or by any one of them individually automatic reflex torquing is obtainable under every working condition, in spite of operator's physical handicaps—deaf, blind, or maimed, or degree of inattentiveness.

This new Sensory feature is built into standard STUR—TEVANT Permanently Accurate Torque Wrenches—the indestructable torque measuring wrench universally used for production, inspection and wherever torque must be accurately gauged. In the Sensory Wrench not a single basic Sturtevant design or construction feature has been sacrificed, though reflex-speed has been added.

7 YEARS OF DEVELOPMENT

basic Sturtevant design or construction feature has been sacrificed, though reflex-speed has been added.

7 YEARS OF DEVELOPMENT

As the torquing of vital screws, nuts and threaded parts became a standard production operation, the need for fast, sturdy and accurate Torque Wrenches became apparent. As the manufacturers of 80% of the torque wrenches in use STURTEVANT has long been aware of this need. As creators of the Sturtevant Design Principle which eliminated all fragile mechanisms, springs, gears, glass dials and delicate parts and made possible sturdy, practicable tools that remained permanently accurate in the hands of ordinary workmen, we were determined that our production wrench would have to be not only fast-operating but also sturdly built and above all permanently accurate. As experienced tool makers we also knew that this wrench would have to give more than visual readings to meet every torquing situation.

For more than seven years STURTEVANT engineers have been working intensely on this problem . . . have been exploring, testing, designing, redesigning, perfecting and rejecting innumerable "speed" and "limiting" torque wrenches of all known and many new designs and principles, From this tireless research has evolved a new thing in high speed production torque wrenches, the STURTE-VANT SENSORY Torque Wrench—a wrench that in use is faster than thought, still is a true STURTEVANT Torque Wrench that will stand all ordinary shop abuse and yet remain dead accurate.

THE STURTEVANT SENSORY TORQUE WRENCH

This new wrench loosely resembles the familiar STURTEF.

wrench that will stand all ordinary shop abuse and yet remain dead accurate.

The STURTEVANT SENSORY TORQUE WRENCH

This new wrench closely resembles the familiar STURTE-VANT Torque Wrench in appearance. It's the same size for capacity, weighs about the same also. It too can be dropped into the regular tool box with safety, will withstand the every day abuse given bench tools by careless workmen and still remain "dead accurate" even after long, hard service. It has the same legible STURTEVANT Dials which can be visually read from all working angles. Because experience has shown that visual readings not only provide a quick "check-look", but give the operators the assurance and confidence that they must have and insist upon, our engineers maintained this feature unchanged in the Sensory Wrench. But here is the difference—whereas the Sturtevant Torque Wrench depended solely on visual reading to determine accurate control of applied torque on caps, screws, bolts or threaded parts, the new STURTEVANT SENSORY Torque Wrench embodies two other features—two other safe-guards that help the operator maintain accurate torque at reflex speed—"sound" and "feel."

These Sensory features work as follows: A finger is provided which can be set at any desired signalling point. And from there on, until re-set, as torque is applied with the wrench, at the exact instant the "set" torque is reached, the sensory action (1) Sounds a loud and distinct click and (2) imparts a definite strong impulse to the hand. Thus, through three senses, sight, sound and feeling, the operator automatically releases (by reflex action) his pull on the wrench (even before the conscious mind reports it) making torque both fast and dead accurate. Here, through three channels instead of just one, the operator is conscious that the release point is reached, in spite of himself. Stop and think what accurate "reflex torquing" means:

1. It speeds up production while maintaining accuracy of torquing far beyond that possible with any other fast-

1. It speeds up production while maintaining accuracy of torquing far beyond that possible with any other fast-operating production wrench.

2. Permits accurate torquing in dark or "blind spots." in deatening factory din, and from any working angle under all working conditions.

3. It enables physically handicapped workers, who may have one of these three senses impaired (blind, deaf or maimed) to do accurate torquing.

And for you engineers who like figures, read the results of the following field test made on an actual production line of a large engine builder using three 100 foot-pound Sturterant Sensory Wrenches:

Type of Wrench	Description of Operation	Torque Limits in Ft. Pounds		Number of Nuts Screws Tightened
\$-100	Tightening Cylinder Head Cap Screws (21 per engine	60-65	79	379,447
S-100	Tightening Connecting Red Nuts (12 per engine)		79	227,520
\$-100	Tightening Main Bearings (Main Bearing Cap Screw per Engine)		67	138,249

NOTE: Set only once, the day they were put on the iob. these wrenches were checked periodically and found to be dead accurate throughout the test—no repairs, no re-settings, no adjustments.

Think what this means to industry... to your business in speeding up war production. what it can mean to you in post war competition. Any operator can how torque accurately without watching a dial—can torque automatically, even the wrench automatically "re-cocks" itself after each pull.

ADDISON .

Save Costly Tie-Ups of Large **Production Units with this** LOW-COST, VERSATILE SAW

SPECIFICATIONS WELLS No. 8-

CAPACITY: Rectangular . . 8" x 16"

(Special Guides) . . . 5" x 24" ROUNDS: . . . 8" diameter

MOTOR: . . 1/2 H. P. current optional SPEEDS: Selective 60, 90, 130 ft. per min.

WEIGHT: . Approximately 750 lbs.

You can avoid costly tie-ups of large, special production units in your plant by using a Wells No. 8 Band Saw for odd metalcutting jobs. It can be used on production . . . in stores or tool rooms . . . or on maintenance work.

The Wells No. 8 with 3-speed selection insures efficient operation. Gravity feed and automatic shut-off allows one man to operate 2 or more Wells Band Saws.

Low first cost, installation and power cost. Simple, rugged construction insures long life-minimum upkeep.

See your Distributor or write direct for complete details on this versatile, low-cost metal-cutting band saw.

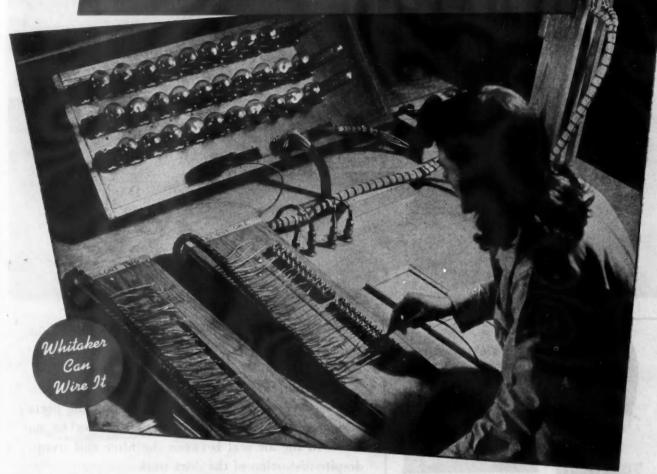




Products by Wells are Practical

ELLS MANUFACTURING CORPORATION 101 JEFFERSON ST., THREE RIVERS, MICHIGAN

PERFECTION assured by quality control



You can be sure your wiring harnesses are okay--if Whitaker produces them

Skilled technicians, utilizing specially designed testing equipment, check every assembly produced by Whitaker. Hundreds of individual tests are made on some assemblies - and when passed by our experts, you can be sure the job is okay.

If your production needs include wiring harnessess, bonding jumpers, or cable assemblies—it will pay you to get in touch with us...Whitaker Cable Corporation, 1305 Burlington Ave., Kansas City 16, Mo. . . St. Joseph, Mo. . . Philadelphia . . Oakland.

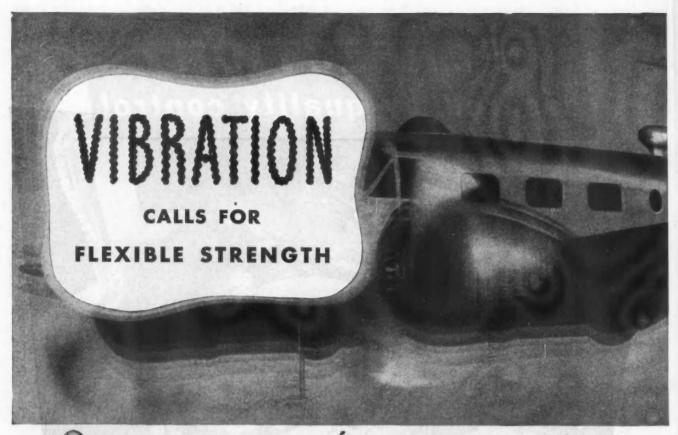
Cables, Wiring Harnesses and Assemblies for Automotive, Aircraft, Marine and Radio Equipment

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STRONG—this 2 inch thick Air-Maze aircraft filter easily supports a 185pound man—proof this extremely light filter is ruggedly constructed.

Built for Aircraft Service!



FLEXIBLE—through ingenious design, strength has been built into Air-Maze aircraft filters without making them "brittle" and subject to breakage from the powerful vibration to which aircraft induction systems are subjected.

Whether a stressed member should be flexible or rigid is not a matter of opinion. It is an engineering conclusion soundly based on concrete facts.

Where aircraft air filters are concerned, the conditions involve intense vibration acting on parts designed for extreme lightness. There can be no break in the air seal between the filter and scoop, despite distortion of the duct work.

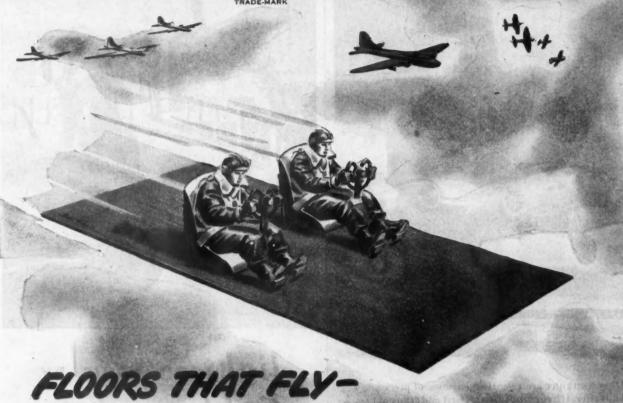
Experience proved that these conditions cannot be ignored. Unless flexibility is consciously and expertly engineered into aircraft air filters, either the holding device must give, allowing air to by-pass the filter, or the filter frame is subject to breakage.

A chief reason for the long life and unfailing performance of Air-Maze filters is that their flexible strength withstands vibration supremely well.

AIR-MAZE CORPORATION • Engineers and Manufacturers • CLEVELAND 5, OHIO

Representatives in Principal Cities • In Canada: Williams & Wilson, Ltd., Montreal, Quebec, Toronto, Windsor; Fleck Bros., Ltd., Vancouver, B. C.





Low-pressure laminated flooring, made with BAKELITE phenolic laminating varnish, is doing an essential weight-saving job in bombers, gliders, and troop carriers. This new flooring material has an extremely high strength-weight ratio as compared to the sheet metal and plywood formerly used. It is produced, too, with an ease and speed that effect substantial economies.

This lightweight, durable flooring, a product of Consolidated Water Power and Paper Company's Plastic Division, is formed by low-pressure laminating-molding with BAKELITE resin varnish BV-16526. Its wood veneer core is surfaced with high-strength Consoweld, a Mitscherlich sulphite paper. Laminating pressure is about 200 lb. per sq. in. Regular hydraulic presses produce the flooring in 6 ft. by 16 ft. sections. Surface color is incorporated in the paper stock, and the surface is embossed in the single press operation to secure a safe, non-skid finish. Edges are sealed for thorough moisture resistance.

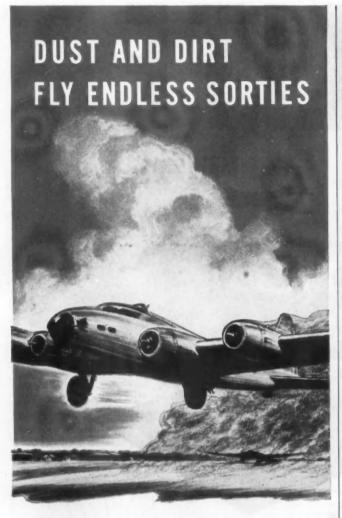
Low-pressure laminating-molding opens

many opportunities for reducing the weight of products, without loss of mechanical strength or dimensional stability. Even the molding of structures with compound curves is an everyday procedure. Write Department 27 for further information on the advantages of this new technique. It may be of outstanding value in essential production now, or help guide your planning for tomorrow.



BAKELITE CORPORATION

Unit of Union Carbide and Carbon Corporation 30 EAST 42ND STREET, NEW YORK 17, N.Y.



DUST AND DIRT are relentless enemies of precisionbuilt aircraft hydraulic systems. Grit and grimy abrasives can damage or clog the valves, causing landing gears, wing flaps, gun turrets, and bomb bay doors to jam at the critical moment.

The Purolator hydraulic oil filter intercepts the tiniest particles of grime before they can do any damage. In addition, it is extremely light in weight, small in size and meets all army and navy specifications. In all parts of the world, Purolator filters are keeping aircraft automatic hydraulic systems clean and in flawless operation under all conditions of climate.

Purolator also manufactures highly efficient air filters for vacuum operated aircraft instruments and a complete line of lubricating oil filters. Write for Purolator "Aviation" catalog. Purolator Products Inc., Founder and leader of the oil filter industry.





light to DRIVE BY

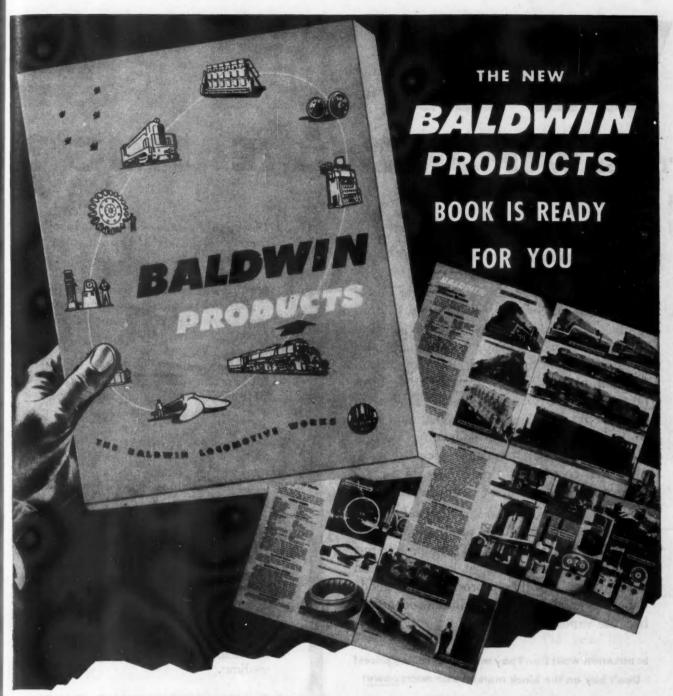
The record for dependability of nearly a half century in the automotive industry no doubt prompted the adoption of TUNG-SOL Lamps for aircraft use. TUNG-SOL Lamps are maintaining this creditable record in cars, trucks and tanks as well as in planes throughout the world under the severity of wartime conditions. When you specify TUNG-SOL for initial equipment and replacements you know you are ordering lamps of proven quality.



TUNG-SOL AIRCRAFT LAMPS



TUNG-SOL LAMP WORKS INC., NEWARK 4, N. J., Soles Offices: ATLANTA, CHICAGO, DALLAS, DENVER, DETROIT, LOS ANGELES, NEW YORK, PMILADELPHIA. ALSO MANUFACTURERS OF ELECTRONIC TUBES AND CURRENT INTERMITTORS



There is hardly an industrial field that does not use one or more of the many products listed and pictured on the pages of this new Baldwin bulletin. Between its covers you may find ways that Baldwin can help you with your immediate production problems or with your post-war plans.

A handy index of all the major products of The Baldwin Group, arranged in accordance with their applications in particular industries, will enable you to see at a glance where Baldwin can be of service. A request for Bulletin 211, on your regular letterhead, will bring this book to your desk without obligation on your part.

The Baldwin Locomotive Works, Philadelphia, Pa., U. S. A. Offices: Philadelphia, New York, Chicago, Washington, Boston, Cleveland, St. Louis, San Francisco, Detroit, Houston.



BALDWIN

The Baldwin Locomotive Works, Philadelphia, Pennsylvania: Locomotive & Ordnance Division; Baldwin Southwark Division; Cramp Brass and Iron Foundries Division; Standard Steel Works Division; The Whitcomb Locomotive Co.; The Pelton Water Wheel Co.; The Midvale Co.

WHERE

TO USE VAPOR DEGREASING*?

Any piace in metal fabrications where quick and thorough removal of oil and grease is required—whether for accurate inspection during machining operations, assembly, or for preparation of clean surfaces for subsequent application of decorative or protective finishes—that's where vapor degreasing should be used! The method is quick. It is economical. It is simple but most effective. It requires only Trichlorethylene or Perchlorethylene in equipment which has been designed and built for its efficient use in metal cleaning. Both of these non-flammable solvents, specially manufactured to meet the requirements for degreasing, are available for essential uses.

Vapor degreasing is basic to good metalcleaning practice. In war production, it has proved its outstanding value in helping to put metal parts in use faster, at less cost. When peace comes, it will help produce more goods —better goods—with maximum economy, because vapor degreasing—

BE INFLATION WISE! Don't pay more than ceiling prices!

Don't buy on the black market! KEEP PRICES DOWN!



BETTER THINGS FOR BETTER LIVING ... THROUGH CHEMISTRY

- **1. Thoroughly removes grease** and oil from metal parts of any size or shape, usually in a minute or so.
- 2. Produces parts clean, warm and dry
 —ready for inspection, assembly, further fabrication or finishing of any
 type.
- 3. Minimizes finishing rejects because vapor reaches and removes grease and oil from deep draws, holes and places which are almost inaccessible.
- 4. Reduces risk of damage to delicate parts.
- 5. Can be used alone or as a part of a process flow line.
- 6. Utilizes compact equipment that fits into small space.
- 7. Consumes only small quantities of solvent. Contaminated solvent is recovered economically for re-use.
- 8. Uses the absolutely pure vapors of a non-flammable solvent as a cleaning medium.
- **9.** Simplifies cleaning procedure, is easy to operate as a process.
- 10 Saves time and cost—in its own operation, and in the subsequent handling and finishing of parts.

E. I. DU PONT DE NEMOURS & CO. (INC.)

Electrochemicals Department

Wilmington 98, Delaware

*Vapor degreasing is basic for good metal cleaning. For each job there is a suitable cycle or combination of treatments. In every case, the final rinse in pure, uncontaminated solvent vapor assures positive removal of the last traces of grease and oil.



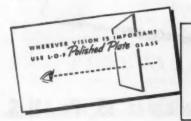
Hour after hour . . . mile after mile . . . the driver keeps his eyes glued on the road, watchful for thousands of conditions which dictate his driving actions.

He drives according to what he sees. And that's why clear visibility is of firstranking importance to highway safety . . . why it is vital to prevent eye fatigue that can result from minor optical distortions in glass.

Because it is clearer, flatter and freer

from optical distortions, many of America's car manufacturers have used Safety Glass made of Libbey Owens Ford Polished Plate Glass throughout their cars-in windshields and in the equally important side and rear windows as well.

In working out designs for tomorrow's cars...remember that good glass is important to highway safety. Libbey Owens Ford Glass Company, 4094 Nicholas Building, Toledo 3, Ohio.





LIBBEY · OWENS · FORD a Great Name in GLASS'



DISSTON

STANDARD ALLOY STEEL

(Including National Emergency Steel Compositions)



Aircraft quality for AIRPLANE PARTS



Gun quality for **GUN BARRELS, RIFLE** AND TORPEDO PARTS

Produced by modern steel practice in electric furnaces. from carefully selected materials, under expert supervision and precise control.



YOUR POSTWAR PLANS

most likely include the use of special steels. Disston metallurgists and engineers can put at your service an unusual background of experience with tool, alloy and carbon steels to help you with your future problems. There is no obligation. Write fully in confidence.

HENRY DISSTON & SONS, INC., 931 Tacony, Philadelphia 35, Pa., U. S. A.

THE ANSWER TO MANY PRODUCTION PROBLEMS



Tremendous war-time demands have resulted in the development of scores of new uses for Federal Dial Feed Presses. And every day, these versatile presses are solving more production problems-performing a wider variety of jobs which, until recently, were not thought of as press operations.

Originally employed for secondary operations only, Federal Dial Feeds are now being used for primary and assembly work as well; in some cases, perform intricate combinations of all. Burnishing, broaching, forming, staking, and high speed marking are also handled with ease. The need for highly specialized machinery of limited utility is often eliminated. And production speed is often increased as much as 3 to 6 times.

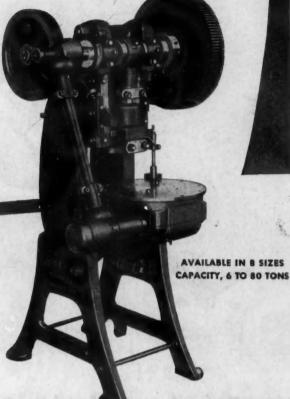
Federal Presses will be equally effective tomorrow, for hundreds of uses in low-cost peace-time productionwith practically no reconversion costs. Orders are now being accepted for prompt post-war delivery.



WRITE FOR NEW CATALOG

Valuable new catalog illustrates and describes complete line of Federal Dial Feeds and Open-Back Inclinable Presses. Just write--

THE FEDERAL PRESS CO. 509 Division Street, Elkhart, Indiana.

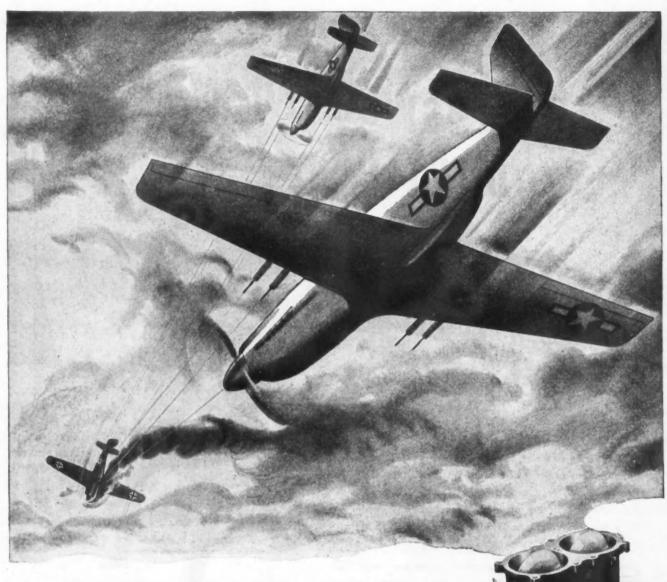




Special application of Federal Dial Feed Press in operation on bullet parts-20 stations, 60 to 80 strokes per minute.



ES



Stromberg Injection Carburetion "Raises the Roof" of fighter efficiency

A Stromberg Injection Carburetor is standard equipment in the fastest and highest climbing fighter in existence for this excellent reason: The Stromberg Injection Carburetor automatically and instantly compensates for changes in altitude, position, temperature and speed. The gas mixture is always right for all flying conditions. And keeping our pilots on top is only one of its advantages. It has notably increased flight range as well. This ability to get more miles from a given fuel load will naturally make these Bendix-built and designed carburetors vastly important to the cargo planes of the future.

FOR TOP-FLIGHT PERFORMANCE

The Stromberg Injection Carburetor has considerably increased the ceiling as well as the range of fighting and bombing planes. And Bendix—with the finest research facilities in its field—continues to make improvements. Watch Bendix for the latest advancements in Injection Carburetion.

Bendix PRODUCTS DIVISION Bendix Aviation Corporation, South Bend 20, Indiana

PROTECT the crank pin bearing, main bearings and gibs on your punch presses



Do more than before BUY EXTRA BONDS in the 5th War Loan!

LUBRICATING SYSTEMS

Available in Complete Kits for Standard Punch Presses

Save man hours...machine hours... bearings...power—and reduce accidents by equipping your machines with Centro-Matic Lubricating Systems. Lincoln Centro-Matic packages include 5, 7, 9, or 11 injectors, lubricant pump, necessary tubing, brackets, bolts, fittings, and complete installation and operating instructions everything to make the installation. They are simple to install. No special tools needed. Ask your nearest Lincoln Distributor for details, or mail in the coupon below.

I WOULD LIKE TO HAVE FREE BULLETIN On Centro-Matic packages for punch presses.

Name______

Company

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CINCOLN

ENGINEERING COMPANY

Pioneer Builders of Engineered Lubricating Equipment

State

5701 NATURAL BRIDGE AVE., ST. LOUIS 20, MO., U. S. A.





Inland-made Tank Tracks of both rubber and metal give speed and mobility to tank destroyers and light and medium tanks, whose armored fire power has been an important factor in the Allied Invasions of France and Italy.

Stemming back to June before Pearl Harbor is Inland's experience in applying its rubber know-how to the quantity and quality manufacture of Tank Tracks for America's now famous mobile fire power

Tank Tracks—one of the many Inland products for Victory—are helping invading Americans blast through desperate Axis defenses on the fighting fronts of the globe.

INLAND MANUFACTURING DIVISION, General Motors Corporation, Dayton, Ohio



Inland Products for Victory include Carbines, Tank Tracks, Gun Sights, Helmet Liners, Extinguisher Horns, and Rubber, Synthetic Rubber and Metal Parts for Tanks, Aircraft, Submarine Chasers, Torpedo Boats, Artillery Lighters and Landing Craft.

Rubber, METAL, PLASTICS

aabtable

to any need for remote control

TRU-LAY PUSH-PULL CONTROLS are being used in so many and such varied ways that it would be impossible to list their applications. If you have a problem involving remote control, the only question is which particular size and type of TRU-LAY PUSH-PULL will serve you best.

SIZES

Standard Tru-Lay Push-Pull controls are made in any length. The armored strand that forms the operating member is made in a selection of three sizes: 1/2, 1/6, and 1/4 inch.

MOVEMENTS

Regular Tru-Lay Push-Pull controls are standard with 1, 2, 3, and 4 inch movement. (Movement of more than 4 inches on special order.) Micro Push-Pull has 31/2 inch movement only.

TYPES

Regular Push-Pull allows for manual adjustment anywhere between the "on" and "off" position. Micro Push-Pull permits micro adjustment, either forward or back, from any point in the range of the control. Fixed Position Push-Pull allows quick, exact adjustment to two or more fixed positions.

WORK FITTINGS

The fitting on the work end may be either rigid or with an 8-degree swivel joint designed to follow the arc of a lever or other such device.

> Write us for specific information about TRU-LAY PUSH-PULL CONTROLS.

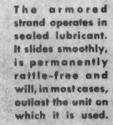
AUTOMOTIVE CONTROLS

AUTOMOTIVE AND AIRCRAFT DIVISION

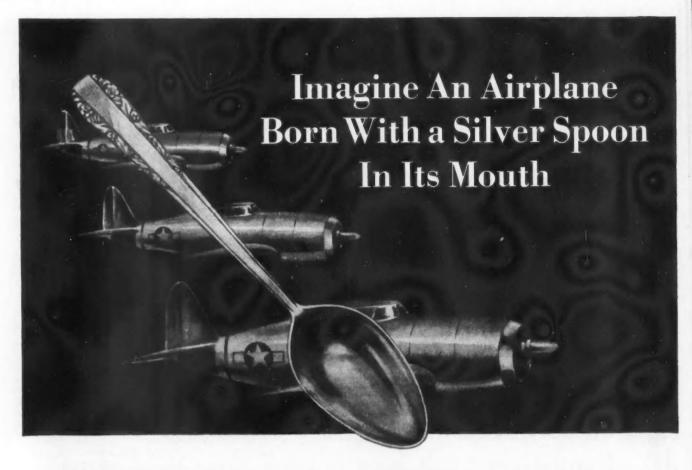
6-235 GENERAL MOTORS BUILDING, DETROIT 2 - 695 BRYANT STREET, SAN FRANCISCO 7 AMERICAN CHAIN & CABLE COMPANY, Inc., BRIDGEPORT, CONNECTICUT

In Business for Your Safety

Also Manufacturers of TRU-STOP Emergency BRAKES with ventilated discs that dissipate the heat of braking







ESS THAN TWO YEARS AGO, fighter planes powered with 2000 horsepower engines first winged their way to fame-and victorious combat. Literally, each was born "with a silver spoon in its mouth," which is to say its tough, durable engine was equipped with Mallory silverbonded bearings.

Through the Mallosil* Process of bonding rare metals to base metal backings-plus precision



production and improved methods of inspection -Mallory provides a bearing that withstands constantly higher speeds, greater impacts, increased pressures. In the Mallosil Process exact control is inherent, which insures uniformity and dependability for master connecting rod bearings, rocker arm bushings, pinion races, counter weight bushings, spacers, oil seals and other aircraft engine parts.

Although Mallory bearings are now devoted to war production, it is not too soon to consider them in connection with your future plans. Having helped to revolutionize engine performance in the aircraft industry, they are readily adaptable to the automotive, marine, railway, machine tool, rolling mill and turbine fields.

Talk it over with Mallory engineers. Do it now -while designs are still in the blue print stage. *Reg. U. S. Pat. Off.



P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

THE AVIATION, THE AVIATION-INSTRUMENT AVIATION - COMMUNICATION FIELD TIPS, THE MALLOSIL* PROCESS - BEARINGS, SPECIAL ALLOYS, VIBRAPACKS," CONDENSERS, ROTARY AND PUSH BUTTON ELECTRONIC EQUIPMENT, COMMUNICATIONS HARDWARE, RECTOSTAR



RESISTOFLEX instrument lines on PV-1 Bombers do not swell, crack or slough off

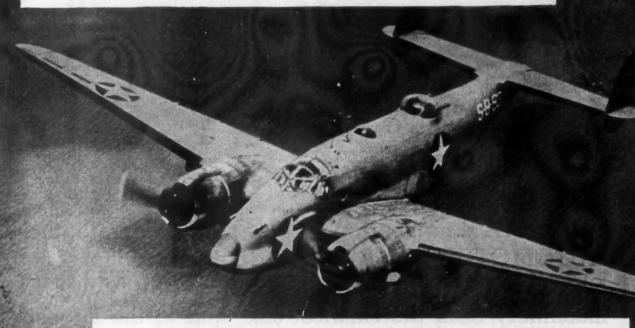
They have never failed from vibration or flexing.

There's no danger of gumming or internal erosion of Resistoflex instrument lines on the Navy's hard-hitting Vega "Ventura" (PV-1) Bombers. These hose assemblies have a tube of Compar, the chemically inert elastomer. As formulated for aircraft service, Compar is completely impervious to hydraulic fluids, lubricants, gasoline, fuel blends . . . even those with the highest aromatic content. Skin friction and turbulence are reduced to

a minimum, too, by the glass-smooth surface of Compar.

Exceptional strength, toughness and flexibility are other outstanding advantages of Resistoflex aircraft hose. It's built for heavy duty—withstands severe shock loads.

Resistoflex hose assemblies are available in all standard lengths and dimensions for instrument and medium pressure hydraulic lines... meet applicable Army and Navy specifications. Full details given in the Resistoflex Aircraft Catalog... Write for it!

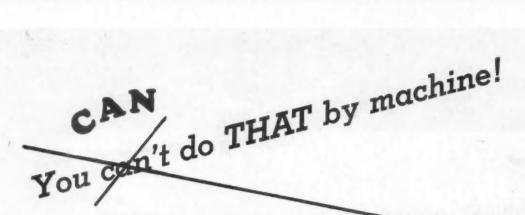


RESISTOFLEX

Low and Medium Pressure Hose Assemblies—Manometer Tubing—Dipped and Molded Specialties

RESISTOFLEX CORPORATION

BELLEVILLE 9, NEW JERSEY



by Scandia Engineers, solved the only hand-operated, muscle-breaking job on an otherwise perfect production line.**

**Scandia torque machine tightens crankshaft clamping bolts until they have stretched 0.009 inches. Formerly a backbreaking manual operation requiring an 8 ft. wrench, Scandia assures exact torque, and speeds up operation.

SCANDIA Engineering "Know-how" offers to the AUTOMOTIVE and AVIATION field, exceptional facilities for designing and building automatic TORQUE machinery from the smallest size stud to the largest size engine bolt.

Scandia MANUFACTURING CO.

NORTH ARLINGTON

NEW JERSEY

METAL STAMPINGS OF QUALITY



n



Then You Can Buy and Use Them Economically and Safely

Tool bit costs, because of failure due to cracks or poor bonding, are a large item of expense. The ordinary visual check made by most tool departments on purchase and after regrinding falls far short of the mark. It is unable to catch the small, tight, failure-producing cracks common to carbide tips.

Carbide tip manufacturers and modern tool departments are rapidly turning to Zyglo to reduce tool costs and cut losses in scrapped products spoiled by broken tools. Zyglo, the new, rapid, non-destructive inspection method, shows with spectacular exactness the causes of possible failure in service, poor bond to parent metal, or grinding or other cracks.

Zyglo is used to check all types of metals, plastics, ceramics, and other materials for surface cracks and openings. It discloses these flaws as glowing fluorescent lines. Our field engineers will point out the many Zyglo applications in your plant.



*ZYGLO-The Trade Mark of Magnaflux Corporation applied to its equipment, material and methods for fluorescent penetrant inspection.

ALLOY TIPPED -TOOLS-

MILLING

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COUNTERSINKS

DRIVING

JOBBERS'

MACHINE

REVERSE SPOT

SHELL END

ROSE SHELL REAMERS

COUNTERBORE CUTTERS

FOR HIGHER SPEEDS

• Where cutting speeds must be increased to keep pace with modern methods, Scully-Jones and Company standard tungsten carbide and Haynes Stellite tipped tools effect substantial savings by increasing production, giving better finish, longer tool life with less regrinding, and lower cost per unit produced.

Years of experience and engineering knowledge assure correct grades of alloys for your particular job. Our facilities provide prompt and dependable service.

Kindly send drawings or specifications for quotations on special tools.

CORE

SHELL

SCULLY SAND COMPANY Y JONES

1901 SOUTH ROCKWELL STREET & CHICAGO, U. S. A.

T&W FORGINGS

usually cost less at the point of assembly

Prepare now to meet postwar competitive conditions by improving your product with forgings. The metal quality inherent in a specific grade of steel may be fully developed in forgings. Excellent physical properties resulting from controlled grain flow may be developed, by forging and heat treating processes, to the exact degree required to meet a specific service condition. Forgings provide greater strength in lighter sectional thicknesses, thus reducing dead weight, and forgings can help you win tomorrow's battle of costs. Forgings formed to close tolerances usually require less machining and finishing, take less time to get to the assembly line, and usually cost less at the point of assembly. At T & W the availability of a hammer of the right capacity to form a forging is secondary to whether or not experience shows it to be the hammer in which metal quality may be fully developed and the forging formed to close tolerances. The primary objective is to utilize forging equipment in a manner that will verify the claim that T & W Forgings usually cost less at the point of assembly. Ask a T & W Forging Engineer for suggestions which may help you meet postwar conditions.



TRANSUE & WILLIAMS

STEEL FORGING CORPORATION · ALLIANCE, O.

SALES OFFICES: NEW YORK, PHILADELPHIA, CHICAGO, INDIANAPOLIS, DETROIT AND CLEVELAND



Snyder can show you how to control production factors that control costs!

SNYDER KNOWS HOW

This special-purpose automatic-cycle machine was designed and built by Snyder for drilling and precision reaming 24 holes in aircraft cylinder heads. Work is located on two dowels and clamped manually. When the cycle starter button is pressed the machine automatically goes through a complete work cycle as follows: Fixture moves into first working position, shot pin locates fixture and slide accurately, head is released and performs drilling operation, fixture and slide move from first position (drilling) to second for reaming, the 24 drilled holes are finished reamed, fixture and slide return to unloading stop. To assure precision reaming, two vertical guide bars (with rack teeth engaging a pinion cross-shaft) extend from fixture base to head casting and keep both ends of head moving downward in parallel.

The best way to "give yourself a brake" on postwar production costs is to establish control of those factors which make up cost.

Factory floor space costs money. Special-purpose machines often save floor space by combining in a single machine, operations which ordinarily would be spread over several standard machines occupying much more floor space.

Machine tool investment often can be reduced through the use of special-purpose machines performing multiple operations and eliminating the need for "batteries" of standard machines.

Production rate can be controlled through the automatic time cycle which is a feature of many specialpurpose machines. The rate is set to meet your requirements.

Quality can be controlled by means of devices which automatically maintain specified tolerances and finish. Rejects and scrap are minimized.

Tool cost can be controlled through automatic operation which reduces

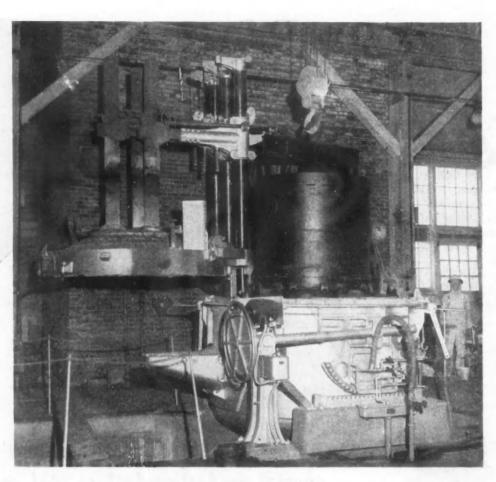
the element of human skill as a cost factor. That, in brief, is the reason for the special-purpose machine and because it makes sense to so many production minded, cost-conscious executives, it is also a good reason for doing something NOW about the machines you will need for postwar production.

Snyder, with 20 years experience in designing and building special-purpose machines for American industry is ready to consult with you. We invite you to write in full confidence. Snyder Tool & Engineering Company, 3400 E. Lafayette, Detroit 7, Michigan.

PLAN Your PRODUCTION
when you
PLAN Your PRODUCT

DESIGNERS AND BUILDERS OF SPECIAL-PURPOSE MACHINES FOR HIGH PRODUCTION AT LOW UNIT COST

20 years of Successful Co-operation with Leading American Industries



2 ton per hour Lectromelt being charged by drop bottom charge bucket.

MOORE RAPID Lectromelt FURNACES

The improved Lectromelt furnace of the top charge type, with the swing-aside roof, has demonstrated its economy, dependability and ease of operation in hundreds of foundries and ingot mill installations. It is easily charged by moving one valve mechanism which lifts and swings aside the roof, super-structure and electrodes, while the overhead crane positions the charge in a drop bottom bucket, which may be loaded by an electro-magnet. The bucket is lowered by the crane and discharged, then raised and returned for



reloading, as the furnace helper by turning the valve mechanism swings the roof and super-structure back into place. Top charge type Lectromelts charge quickly, thus reducing idle time between heats, and increasing the tonnage per man hour. Complete information sent without obligation.

PITTSBURGH LECTROMELT FURNACE CORP.

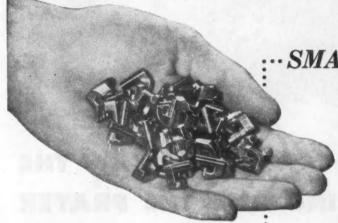
PITTSBURGH, PENNSYLVANIA

WADSWORTH

in one year produced and delivered 2,564,913

of these





- This handful of 59 of these small steel parts weighs only 5.9 ounces.
- Yet this 5.9 ounces represents 6.83 hours of precision work, subject to most critical inspection.
- Through Wadsworth Engineering for Mass Production and Wadsworth Operating Economies, a 36% Cost Reduction has been effected and passed on to the customer.

WADSWORTH FACILITIES

Die Making Jigs & Fixtures Gage Making Model Building Milling Drilling Turning Stamping Screw Machinina **Hard Soldering** Line Assembly Polishing Lacquerina Photo Etching Silk Screening **Product Decorating Metals Laboratory Engineering Design Product Design**

CURRENTLY SERVING THESE INDUSTRIES

Aircraft
Automotive
Bearing
Electronics
Instruments
Machine Tool
Small Arms
Refrigeration

Wadsworth is making small precision parts for forty-five major companies which normally manufacture such products as radio equipment, refrigerators, automotive parts, precision instruments.

After the war, Wadsworth's small parts facilities can be of important assistance to many manufacturers in holding sales in a competitive market.

We shall be pleased to discuss with you the production of those small parts and assemblies you have found a problem in the past and may soon require again.



SMALL PARTS DIVISION

THE Sadsworth WATCH CASE CO., INC

DAYTON, KENTUCKY, SUBURB OF CINCINNATI, OHIO

*



An important adjunct to the "wing and the prayer" that have brought so many shattered planes back home, is the genius of aircraft engineers in foreseeing vulnerability in vital parts

One good way to offset vulnerability is to use elements that are least susceptible to damage. That's one reason for the extensive and continually increasing use of S. S. White Flexible Shafts in aircraft, for power drives and remote controls. Inherently, they are far less likely to be put out of commission than other elements which might be used for the same purposes.

That's why it is well for aircraft and aircraft accessories engineers to KNOW the range and scope of S. S. White Flexible Shafts, and to consider them first, whenever a power drive or remote control proposition comes up.

IT WILL PAY ALL ENGINEERS to know the range and scope of S. S. White Power Drive and Remote Control Flexible Shafts. BULLETIN 43 gives basic data. Write for your copy —today.

MOLDED RESISTORS

FLEXIBLE SHAFT TOOLS

FORGINGS YOU GET MAXIMUM METAL QUALITY

7 ADVANTAGES of FORGINGS

To be sure that you're getting all of the benefits of forgings re-check the forgings you use against these 7 advantages.

NO PROGRAMS HAVE BEEN HELD UP FOR LACK OF FORGINGS

1 FORGINGS CONSERVE METAL



Strength is a primary quality advantage of Strength is a primary quality advantage of forgings. The metal bulk of many parts. norgings. The metal bulk of many parts, may be reduced because maximum tensile. may be reduced because maximum tensite and torsional strength is obtainable in forgings through controlled grain flow and distribution of metal.

FORGINGS LESSEN SCRAP



In forgings it is possible to obtain uniform. In forgings it is possible to obtain uniformed ity of physical properties in the exact degree desired. Practically no rejections results. Heat treating forgings is a straight-forward production procedure, controllable at all times.

3 FORGINGS CONSERVE METAL BY WEIGHT



Reduction of dead weight is a common result of using forged parts because forging produces maximum thereby permitting the tional thicknesses, the parts.

4 FORGINGS FACILITATE RAPID ASSEMBLY THROUGH WELDING ADAPTABILITY



Forgings provide a welding adaptability of widest range for fabricating complicated parts from two or more forgings,

FORGINGS REQUIRE LESS TIME TO MACHINE AND FINISH



N

Forgings are shaped in closed dies and require a minimum of machining of finish to because there is no bulk of excess metal to remove, and freedom rejections.

6 FORGINGS REDUCE ACCIDENTS TO MEN



Freedom from concealed defects is an out-standing characteristic of forgings that underlies the greater margin of safety that forgings afford for men, machines and material.

7 FORGINGS CAN TAKE IT



By the forging process, stamina is achieved through concentration of grain structure and fibre formation at points or greatest shock and strain. Forgings provide high shock and strain, strain, strain the underlies dependently the performance, and continuous operation over longer periods of use.

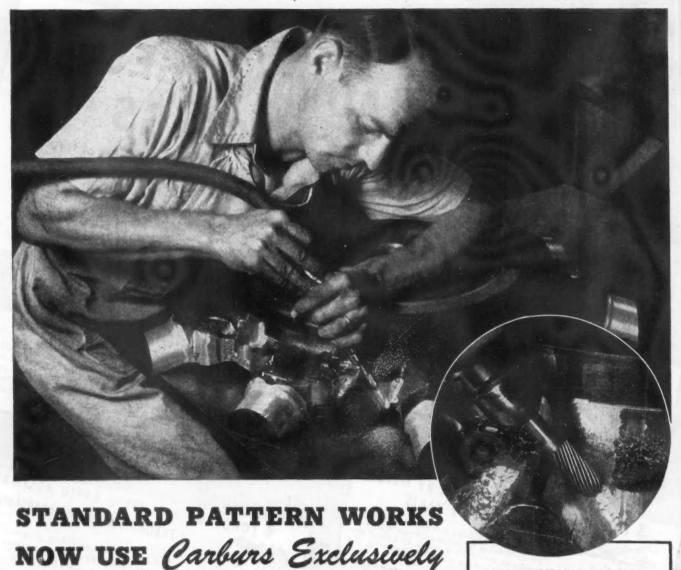
 Consult a Forging Engineer connected with your source of supply whose broad experience may be helpful to you in checking your use of forgings against these advantages

DROP FORGING ASSOCIATION

605 Hanna Building

Cleveland, Ohio

Drop Forging Topics contains technical informa-tion for design engineers, production executives, metallurgists and other technicians who are devoting all their effort to speeding up the production of fighting equipment. If you do not receive "Topics" regularly, send us your name. It's free,



Carburs are the ideal rotary files for pattern shop work . . . as now evidenced by their use at Standard Pattern Works—one of the leading concerns of this type in the Detroit area. Says Mr. E. J. Swink, president of Standard Pattern, "We find that Carburs are excellent tools for our type of work. Those that we have had in use since our first order was placed months ago still show little or no evidence of wear. We have been able to greatly reduce burring and cutting time on aluminum and brass because these tools can be run faster and there is little clogging of chips in the teeth to reduce cutting efficiency. We are now using them exclusively on all operations where a rotary file can be used."

Carburs—industry's first cemented-carbide rotary files—are now available in twelve standard shapes, each in from four to six different sizes and from fine to coarse cut. Special shapes and sizes can also be produced to meet specific needs. A new booklet contains complete information. Write for your copy today.

A FULL YEAR'S USE WITH THIS ONE CARBUR

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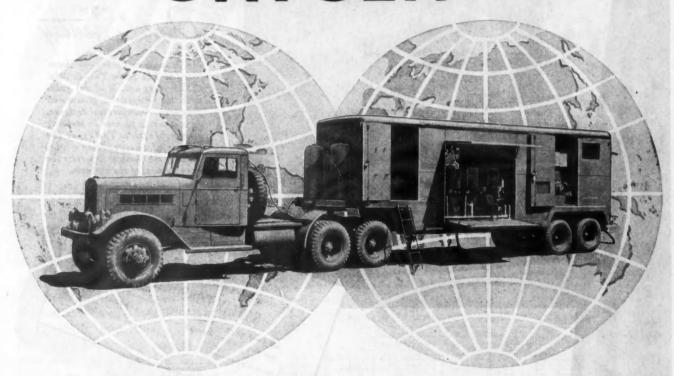
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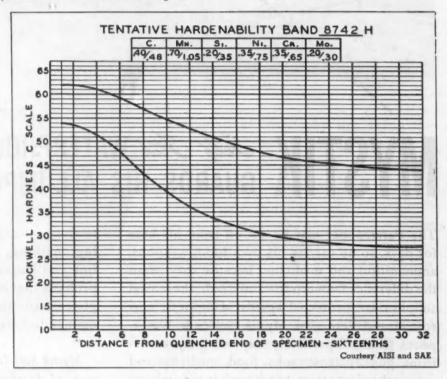
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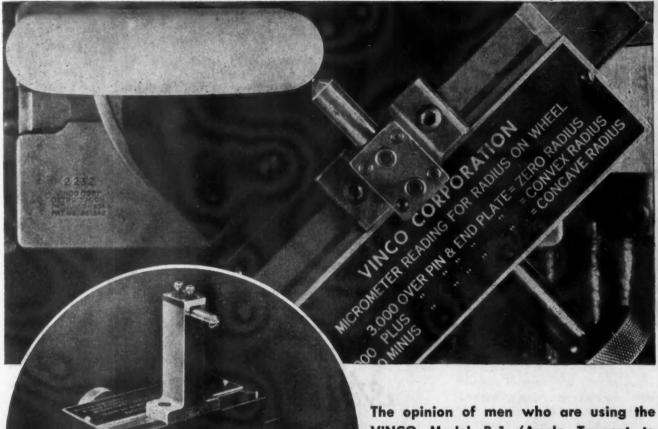
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But let's not start the cheering yet.

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Our leaders have told us, over and over again, that the smashing of the Axis will be a slow job, a dangerous job, a bloody job. And they've told us what our own common sense confirms: that, if we at home start throwing our hats in the air and easing up before the job's completely done, it will be slower, more dangerous, bloodier.

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Let's keep bearing down till we get the news of final victory from the only place such news can come: the battle-line.

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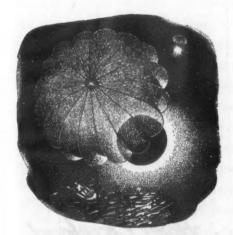
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War Contract Termination

(Continued from page 122)

of PR-15 which interpret and implement Section 12.

Note that PR-15 requires that a contractor must make a demand for removal in order to start the 60-day removal period running and that this demand must be accompanied by a satisfactory inventory list and by a tender of title free and clear of all liens and encumbrances. In order for a contractor to have the right to remove the materials and store them at the risk and expense of the Government, in the event the Government fails to remove the materials, he must under Section 12 of the Act give 20 days' notice of the intended removal. This notice must be accompanied by a statement setting forth the quantities and condition of the materials to be removed.

Recently the Aircraft Scheduling Unit issued instructions to aircraft contractors that Form ASU-46 must be filed as a separate supplement to the standard termination inventory form, listing controlled materials, hardware and certain standard component parts for disposal purposes, and that until termination inventories or materials of such types are so reported on ASU-46 contractors will not be deemed to file a satisfactory statement of such property with the Government and the period in which the Government is required to remove such property from the contractor's plant shall not commence to run. The Contract Settlement Act specifies, under Section 6, that "Costs incurred in respect to facilities, materials, or services purchased, or work done in excess of the reasonable quantitative requirements of the entire contract" shall not be included as elements of cost in termination claims.

Market conditions are changing very rapidly and executives responsible for departments in control of the placing of commitments should establish policies, the effect of which will be to reduce procurement lead times drastically to take proper advantage of the situation. Such a program will automatically make a contribution to the reduction of the amount of in-plant inventory which should also be examined to determine that internal manufacture lead time requirements are reduced to remain in line with current conditions.

Some contractors, particularly in the aircraft industry, now have war inventories in excess of the requirements of open orders in their possession for which they will have no peacetime use and consequently have a very serious problem on their hands. Recognition should be given by the Services at the time of termination to the fact that members of the aircraft industry were precluded from taking the various precautions which otherwise would have prevented the accumulation of excess material.

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contractor should now give serious consideration is the matter of interim financing. Obviously there are a great many things which the contractor should do. In the first place, he should determine which of the several types of interim financing he will seek to obtain. Then he should confer with the person from whom he expects to obtain the financing in order to work out in advance just what the lender will require in the way of information, certificates and maintenance of records pertaining to cancelled contracts. In this connection, the Director of Contract Settlements has issued recently his first regulation under the Contract Settlement Act authorizing the Federal Reserve Banks to approve T-loan guarantees totaling \$500,000 or less to a single borrower.

At plants where the direct settlement experiment is in progress there is one problem which particularly concerns contractors at this time. The same problem will also arise at plants of contractors where a designated technical service, in accordance with Revision No. 39 of PR-15, will approve all dispositions of termination inventories in connection with the termination of subcontracts.

If the customer's property is disposed of in accordance with the authorization of the property disposal officer and it is subsequently found that the terminated purchase order is not allocable to any prime contract (for example in the situation where duplicate purchase orders were inadvertently issued), the subcontractor concerned will have disposed of the customer's property without his consent. Since such subcontractor's only legal rights in this case will be against the private customer the subcontractor will have prejudiced his own legal right by disposing of the customer's property without his consent. To solve this difficulty, some companies have been corresponding with their customers in order to obtain their approval in advance to the disposition of termination inventory and to obtain their consent to accept as proper the allowance resulting from disposition of such material. At the present time there has not been a sufficient response from customers to enable one to say whether or not this problem can be solved in this manner. If industry is reluctant to give blanket approvals for the disposition of termination inventories in these cases, a perplexing problem will exist which may obstruct the prompt disposal of such termination inventories. It is believed that the net gain to industry by cooperating in the direct settlement experiment to this extent would be beneficial.

Responsibility of Officers

At the present time when various contracting officers, negotiators, property disposal officers, and other Government representatives are being stationed at different plants of the contractor, he has the responsibility to obtain copies of authorizations of the

assigned personnel. In order to avoid any later misunderstanding and in order that the contractor does not rely on some misconception of the functions and authority of various termination officers, he should request a statement of the specific functions which each officer is empowered to perform at the particular facility involved. This is particularly true in the case of corporations where one division may be functioning under the direct settlement experiment, another division may be functioning under the Inter-Service Relationship plan referred to in Revision 39 to PR-15, and another division may have no such special situation. The contractor who has obtained such statement with respect to the authority of the personnel assigned to his facilities is in a better position to work successfully and understandingly with such officers.

Settlements of \$10,000 or Less

Under PR-15-437 (a) contracting officers have the power to authorize prime contractors and subcontractors to settle termination claims submitted by their subcontractors and suppliers in cases where the settlement will not call for payment in excess of \$10,000 without deducting disposal credits. However, such authorizations exclude authority to settle claims of subcontractors which are "affiliated" with the authorized contractor.

Contractors who have received such authorizations under PR-15-437 (a) from contracting officers have been faced with the question as to when subcontractors are "affiliated" with them. The Eastern Procurement District has ruled tentatively that all subcontractors whose stock is more than 10 per cent owned by the authorized contractor are "affiliated." The Eastern Procurement District has also ruled tentatively that if the stock of the subcontractor is more than 10 per cent owned by another corporation, which corporation in turn owns more than 10 per cent of the stock of the authorized contractor, then such subcontractor is "affiliated." In other words, the test apparently is one of a 10 per cent ownership in any direction up and down. The delegation of authority to settle subcontractor's claims of \$10,000 or less should expedite the settlement of termination claims. It is therefore suggested that contractors submit to the cognizant contracting officers for their consideration the names of their larger subcontractor to whom the delegation of similar authority would greatly facilitate the settling of claims in the tier immediately below such subcontractor. Contractors and subcontractors should realize that the exercise of this authority adds to their responsibilities in connection with the settlement of terminated contracts. Accordingly, particular attention should be given to the creation of procedures which will assure that adequate reviews are given to all claims settled pursuant to this authority.



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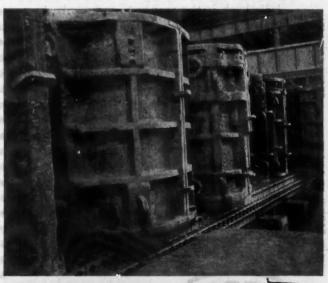
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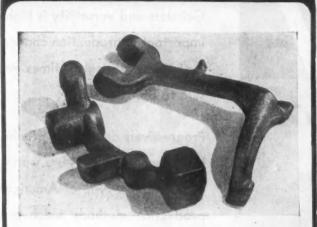


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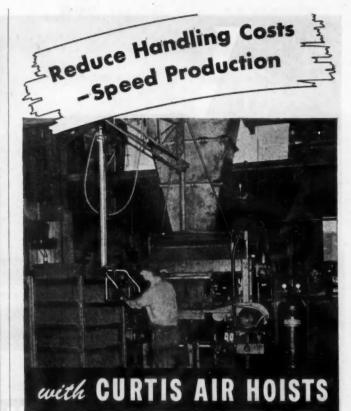
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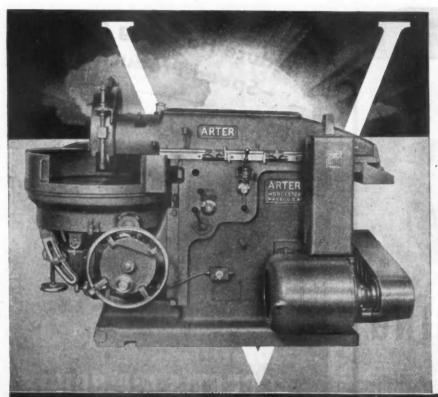
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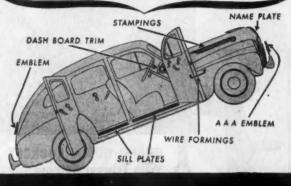
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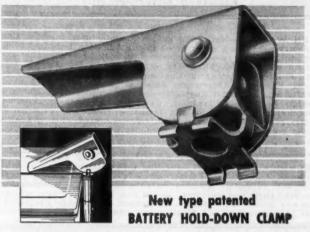
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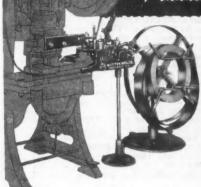
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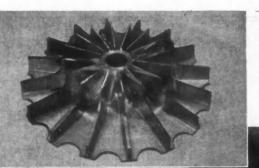
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This shows the finished supercharger impeller for aircraft engines. The sweep milling operation described here follows straddle milling of the fins. The finish obtained on these milling cuts is so fine that only polishing is required.

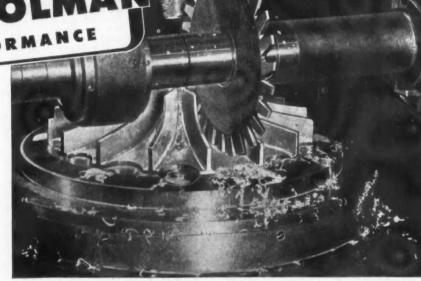


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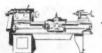
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